

IN THIS ISSUE

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# SCIENTIFIC AMERICAN

*A Weekly Review of Progress in*

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THE MOTOR SLED VERSUS THE DOG SLED IN THE FROZEN NORTH.—[See page 85]

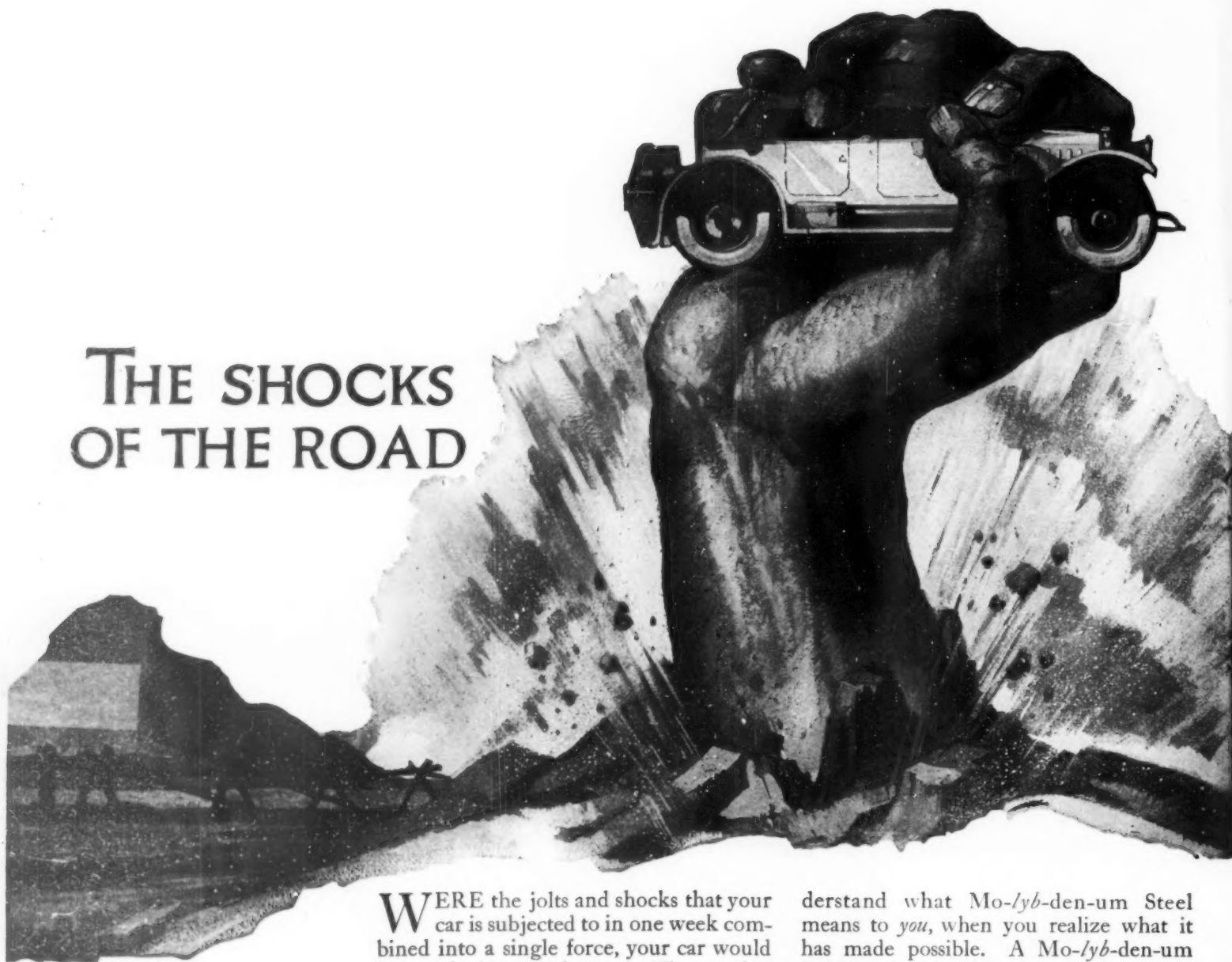
Vol. CXXIV. No. 5  
January 29, 1921

Published Weekly by  
Scientific American Publishing Co.  
Munn & Co., New York, N. Y.

Price 15 Cents  
20 cents in Canada

Entered as second class matter June 18, 1879, at the post office at New York, N. Y., under the Act of March 3, 1879

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# SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXXIV.  
NUMBER 5

NEW YORK, JANUARY 29, 1921

15 CENTS A COPY  
20 CENTS IN CANADA



## The Cost of Living

In each case the size of the object pictured is proportional to the quantity of the commodity purchasable for \$100 at the date in question. The intermediate date in each case represents the price peak so far as we are able to deter-

## Prices—Today, Yesterday and Before the War

By Ralph Howard

GENERAL statements covering the "trend of prices" are dangerous things to trifle with. The truth is that the market in each commodity is more or less independent of that in others. The consumer of automobiles may go "on strike," while the consumer of shoes or of men's clothing is still paying the prices asked. The consumer of building materials can live in the old house for another year, or double up with his brother-in-law or his friend, where the consumer of foodstuffs can be counted on for a certain minimum demand which he cannot escape. The consumer of steel and iron may have to compete with a brisk foreign demand which is absent in the copper and zinc markets. The supply of coal may be curtailed by a strike and the price of cement kept up by some such conspiracy as is suggested by the findings of the New York investigating committee, while the makers of silk and cotton fabrics are slashing prices right and left in the effort to keep their mills running.

So it goes. What is one man's meat is another man's poison, and conditions in no two commodity markets can by any possibility be identical. Nevertheless, we all know that there is a certain degree of parallelism, and that prices go up and come down with considerable unanimity. With every proper reservation as to just what we mean by speaking of the trend

## From 1914 to 1920

mine it. A glance at the relative sizes of the first and third items under each head will make it plain that we have gone well along the road toward lower basic prices

of prices, it is entirely proper and entirely pertinent so to speak.

A survey of the wholesale markets today shows pretty distinctly that the trend is downward. It would be a rash prophet who would risk prediction as to just how far this process of marking down will go and how long it will continue. Obviously, the seller must catch up with the buyer somewhere before he reaches the absolute zero of giving his goods away; and when he does catch up, he need go no further in the downward direction. But if we resolutely turn our backs upon the temptation to prophesy, and make it clear that we are dealing only with what is and in no sense with what is to be, a survey of the existing wholesale commodity prices is encouraging enough to the consumer.

Our figures for this purpose, which follow those put out by the statisticians of the National Bank of Commerce in New York, show first the price on January 15, 1914, six months in round numbers before the beginning of the war in Europe; second, the peak price and the date thereof—in every instance, of course, this peak having been attained after the armistice, while American business was still operating under the idea that Europe would buy and pay for everything we could possibly produce for a couple of decades, and after our producers had been in most cases emancipated from Governmental control; and finally the price on December 15, 1920, representing current quotations.

Our introductory remarks concerning the independence of the various markets

(Continued on page 55)

# SCIENTIFIC AMERICAN

Published by Scientific American Publishing Co.

Founded 1845

New York, Saturday, January 29, 1921

Munn & Co., 233 Broadway, New York

Charles Allen Munn, President; Orson D. Munn, Treasurer  
Allan C. Hoffman, Secretary; all at 233 Broadway

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*The object of this journal is to record accurately and lucidly the latest scientific, mechanical and industrial news of the day. As a weekly journal, it is in a position to announce interesting developments before they are published elsewhere.*

*The Editor is glad to have submitted to him timely articles suitable for these columns, especially when such articles are accompanied by photographs.*

## The Einstein Award

THE Einstein Judges held their final meeting in this office on January 18th. The four essays which were before the committee at the start of the session were speedily cut to three, and then to two; and after an all-day session the Judges found themselves conscientiously able to agree on one of these as the best. This unanimity is especially gratifying, the more so since it by no means was to be confidently expected, on *a priori* grounds, that it would be possible of attainment. Even the Einstein Editor, who might have been called upon for a final decision but wasn't, can hardly be classed as a dissenter; for with some slight mental reservations in favor of an essay which did not enter the Judges' final discussion at all, and which he rather suspects appeals more to his personal taste than to his soundest judgment, he is entirely in accord with the verdict as rendered.

The name and address of the winner appear on the facing page. It would have been a physical possibility to present his essay in this issue, but only at the price of hasty proof-reading, of which we have to do more than enough in the ordinary course of events. We therefore hold it over until next week, when we shall be able to put it before our readers in appropriate dress.

The fact that the prize goes to England will be no surprise to those acquainted with the history of Einstein's theories. The Special Theory, promulgated fifteen years ago, received its fair share of attention from mathematicians all over the world, and is doubtless as well known and as fully appreciated here as elsewhere. But it has never been elevated to a position of any great importance in mathematical theory, simply because of itself, in the absence of its extension to the general case, it deserves little importance. It is merely an interesting bit of abstract speculation.

The General Theory was put out by Einstein in finished form during the war. Owing to the scientific moratorium, his paper, and hence a clear understanding of the new methods and results and the sweeping consequences if the General Theory should prevail, did not attain general circulation outside Germany until some time in 1918 or even later. Had it not been for Eddington it is doubtful that the British astronomers would have realized that the eclipse expeditions were of particular consequence. Therefore at the time of these expeditions, and even as late as the December announcement of the findings, the general body of scientific men in America had not adequately realized the immense distinction between the Special and the General Theories, had not adequately appreciated that the latter led to consequences of any import, and we fear in many cases had not even realized explicitly that the deflection of light and the behavior of Mercury were matters strictly of the General and in no sense of the Special Theory. Certainly when the American newspapers were searching frantically for somebody to interpret to their public the great stir made by the British announcement that Einstein's predictions had been verified, they found no one to do this decently; nor were our magazines much more successful in spite of the greater time they had to devote to the search. In a word, there is not the slightest room for doubt that

American science was in large measure caught asleep at the switch—perhaps for no reason within its control; and that American writers were in no such favorable case to write convincingly on the subject as were their British and continental contemporaries.

So it is quite in accord with what might have been expected to find, on opening the identifying envelopes, that not alone the winning essay, but its two most immediate rivals, come from members of that school of British thought which has been in contact with the Einstein theories in their entirety for two years longer than the average American of equal competence. This riper familiarity with the subject was bound to yield riper fruit. Indeed, had it not been for the handicap of writing in a strange language, it is reasonable to assume that the scientists of Germany would have made a showing superior to that of either Americans or British—and for the same reason that Britain showed to better advantage than America.

Before leaving the subject, we wish to say here a word of appreciation for the manner in which the Judges have discharged their duties. The reader will have difficulty in realizing what it means to read such a number of essays on such a subject. We have been fortunate beyond all expectation in finding Judges who combine a thorough scientific grasp of the mathematical and physical and philosophical aspects of the matter with an extremely human viewpoint which precludes any possibility of an award to an essay that is not properly a popular discussion, and with a willingness to go to meet each other's opinions that is rare, even among those with less ground for confidence in their own views than these gentlemen have.

## New Jersey, the North River and New York

THE phenomenal business growth of Manhattan and the necessity of providing suitable suburban homes for its multitude of workers and carrying them expeditiously to and from their work, presents a problem whose solution becomes increasingly perplexing as the years go by. No sooner is a bridge built or a tunnel opened than it is taxed to the utmost.

Manhattan Island as a residential section has reached its limit. Increasingly, the growth of industry and business is driving the homeseeker to the outlying districts. Evidence of this is seen in the fact that the population of Manhattan showed a decrease in the recent census over that of ten years ago. The only outlet is to the north and the east, and this migration coupled with the rapid growth in population has resulted in a congestion of the rapid transit lines of travel to the Bronx and Long Island, which is already very serious and promises to produce in the near future a positive impasse.

The easiest solution of the problem would be to divert this daily tide of travel, or a portion of it, in some other direction. True; but in what direction? If you placed a map of Manhattan and its environs within a radius of twenty-five miles, before some stranger who knew nothing of state divisions, rivalries and politics, he would undoubtedly point to New Jersey and suggest that the obvious thing to do was to divert the tide of travel in that direction, and so prevent the threatened deadlock on the lines of transportation to the Bronx and Long Island.

If our supposititious stranger were an engineer, a specialist in the problem of city transportation, he would point out at once that there are four great bridges and fourteen tunnels connecting Manhattan and Long Island and only six tunnels connecting Manhattan with New Jersey—or forty lines of rail traffic and four vehicle roadways to the east as against only six lines of rail traffic to the west.

To our answer that New York terminated on the shore of the Hudson River he would make the obvious reply that, in such a vital matter as this, the accidental or arbitrary location of state and city lines should cut no figure whatsoever, and the problem should be judged absolutely by topographical considerations—in other words, that in planning for the industrial and social convenience of a population of seven million people, their interests should be considered as identical.

Apart from the artificial barrier of imaginary state lines and sectional prejudices there is no obstacle to the uninterrupted flow of traffic between Manhattan and New Jersey. The North River, once looked upon as an insuperable obstacle to unbroken rail and high-

way connection, has now ceased to be such—thanks to the genius of the civil engineer. It can be crossed by as many bridges and tunnels as we wish to build.

As to the comparative merit of the two systems there can be no question whatever. Compared on a basis of cost for the same traffic capacity, the bridge is by far the cheaper both in first cost and cost of operation—since vehicular traffic involves a very expensive system of ventilation in any tunnel.

There is much public and official misconception on this subject; it is not understood that, as compared with a bridge crossing, crossing by tunnel is a very extravagant method. To be convinced of this, we have but to consider the great North River Bridge which is to be built at Fifty-ninth Street.

On the two decks of this structure, each of which will be 180 feet wide, there will be accommodation for 8 steam railroad tracks, 6 rapid transit tracks and 14 lines of vehicular traffic, seven each way. To accommodate all this in tunnels would call for 18 tunnels. The Canal Street tunnel is to cost \$28,000,000. If we allow \$22,000,000 per tunnel at present costs, the total would be \$400,000,000. Now the North River Bridge at present prices would cost \$100,000,000, or only one-fourth as much. Considered on the basis of cost, convenience, comfort and health a bridge is the obvious solution.

## When an Invention Is Not an Invention

THERE exists in our patent and copyright laws a gap which has always seemed to us a lamentable one, and one which there is not the slightest justification for leaving unfilled. This has to do with the invention—we use the word though the law denies its propriety—of printed forms for the keeping of accounts or any other purpose.

It goes without saying that much skill and thought may be expended upon the formulation of a set of forms which shall be the last word in furnishing a framework for the proper recording of a certain kind of data. Business of many kinds is dependent upon tabular devices of this sort under one head or another; the invention of such a form may be of great value to its users. It would seem that the man who devotes his time and energy and ingenuity to getting up a thing of the sort ought to be rewarded to the same degree and in the same manner as the man who invents a new safety pin or a novel design for a perfumery bottle or a clever trade-mark. But under the law and the decisions as they now stand he is able to get no protection of any description; you or I or anybody else may manufacture and sell his form in direct competition with him and he has no redress save to undersell us.

The hitch lies in the fact that the law defining invention is so worded that a blank form to be filled in by the user is not an invention. It has no mechanical features, and it is not a process or a product. If the inventor be sufficiently ingenious to design it in such fashion that the user has to punch a hole as part of the process of using it, or join two parts of it in a certain predetermined relationship, or fold the left fifth over upon the right fifth and tear them half off and turn one of them over again in order to bring into juxtaposition two parts of the paper that were originally remote, this constitutes the mechanical feature necessary to make the form stand up under fire as an "invention" entitled to patent protection. But in the absence of such a feature the patent examiners will have nothing to do with it; and if the unhappy inventor turns to the copyright division, he learns that whether his device is an invention or not, it certainly is no publication and he cannot protect it by copyright. Even the feeble solace of a design patent seems denied him.

The situation has long been familiar to us. We are inspired to comment on it by a subscriber who shows us a farmers' account book which he has devised. This is an admirable article, and at the same time it fills a want; for the farmer, never an accountant, is required to keep accounts under penalty of paying an income tax on a lot of income that isn't income. But our subscriber can't advertise his little book decently, for if he does some substitute that doesn't have to meet any advertising expense will appear and wipe out his market. We think he has a grievance against the Government that tells him that an invention is sometimes an invention and sometimes isn't.

## Electricity

**Japan's Electric Lamp Industry.**—An estimate of the total output of electric light bulbs in Japan for the year 1920 is given as 14,000,000 pieces. The demand for bulbs for home consumption is increasing and orders are forthcoming from India, China and the islands in the south.

**National Electrification in Holland.**—On account of the scarcity of coal in Holland, it is proposed to use electricity and to use it economically. The scheme, we learn from the *Electrical Times* of London, provides for the electrification of virtually the whole country, including the industries as well as lighting and railways. It is said that a consumption of 100 kw-hr. per capita is anticipated as compared with from 35 kw-hr. to 40 kw-hr. at present.

**A Water Tank Heater** for application to water containers provided with pipe outlets has been recently designed by an electric manufacturer. This heater fits threaded pipes of 1¼-inch or 2-inch inside diameter. It is inserted through the walls of the vessel below the minimum water level. It is made in various capacities from 500 watts to 4,500 watts, on the standard commercial voltages. The larger sizes have three heats, selected by means of a switch on the heater cord.

**Resonance Coils for Radio.**—Discovery of a new method of sending and receiving radio messages was announced recently by Major-General Geo. O. Squier, according to *The Wireless Age*. Through development, it is probable that wireless will be improved so as to permit the confining of messages to the parties directly interested. The discovery came about through investigations made early in the war on the uses of submerged bare wires. Out of it grew what is now known as a "resonance wave coil." Discussing some of the powers of the new invention, the scientists list the following: It is possible to locate an airplane in flight, to tell the direction of the flight, to tell how high it is flying and to tell by the use of two coils and mathematical deductions the distance of the airplane from the wave coils. The instruments can be used as range finders and in the same manner they can be used for airplane finding. Radio messages can be handled from airplanes without the trailing wires now used. Static interference can be reduced.

**Glass-Covered Meters.**—The use of glass-covered meters is increasing, according to *Electrical World*, and many central station men and manufacturers believe that they will be ordered in greater numbers when deliveries become easier. Companies which are using these meters find that they facilitate the settlement of complaints, especially when a meter is suspected of creeping. Customers prefer a meter that can be seen working. The objections to glass covers have for the most part been overcome. Unevenness of the edge of the cover which might cause a poor fit has been taken care of by a felt gasket, consequently no trouble from this source has been experienced. Condensation, which sometimes appears on the inside of the glass, could be present on the inside of metal covers without being noticed upon inspection of the outside.

**The Superlative in Circuit-Breakers.**—The heaviest circuit-breakers ever designed for 13,200-volt service will be installed by an electric light and power company of New York City, in its Hell Gate station. There will be 120 of these solenoid-operated circuit-breakers, having an interrupting capacity of 58,000 amperes at the arc, 1,500,000 kva. The disconnecting switches are gang operated and their operating mechanism is interlocked with the oil-breaker mechanism.

**Electro-Pneumatic Brakes.**—One of the first trains equipped with the three-wire electro-pneumatic brake and telephone system to be operated over any railroad in the world is now in operation over the Tyrone division of the Pennsylvania railroad. The object of the electro-pneumatic brake, so we are told by *Electrical Review*, is to secure a rapid simultaneous application and a graduated or direct release of the brakes on all cars regardless of the length of the train, thus avoiding the objectionable slack action between cars. A turbo-generator situated at the top of the locomotive smoke-box, generates direct current at a pressure of 110 volts for actuating the electric magnets on the air brake valve of each car. When the engineer switches on the current and applies the air brakes, he is enabled to make a quick, smooth and safe stop, and the objectionable slack action between the cars is thereby avoided.

## Astronomy

**Observations of Faint Variations.**—One of the principal pieces of work carried on at the McCormick Observatory of the University of Virginia is the observations of long-period variables which are so faint at minimum (mostly below the 13th magnitude) as to be beyond the reach of observers with telescopes of moderate aperture. The number of such stars now under observation is 187.

**Dr. Russell's Medal.**—It gives us the greatest pleasure, and a certain amount of pardonable pride, to announce that Prof. Henry Norris Russell of Princeton, for some years the contributor of our monthly astronomical page, has just been awarded the gold medal of the Royal Astronomical Society of London. This is by all means the highest honor that can come to any astronomer, for it goes to the man whose work entitles him to be regarded as the foremost astronomer of the world for the year. Dr. Russell goes to England late this month to receive the medal at the February meeting of the Society. The particular work in recognition of which the award comes is doubtless the theories of stellar evolution which Dr. Russell has been sponsoring for ten years past. At first regarded as entirely too radical, these are now generally accepted, and paved the way for Michelson's extraordinary determination of the diameter of Betelgeuse which Dr. Russell himself describes in the *SCIENTIFIC AMERICAN MONTHLY* for February.

**Astronomical Telegrams.**—The central office for the international exchange of astronomical telegrams was established at the Royal Observatory of Belgium, at Uccle, in 1919, by the International Research Council, and M. Lecointe, director of that observatory, was appointed president of the commission having charge of this work. Observatories and similar establishments throughout the world who subscribe to the international

## THE EINSTEIN AWARD

THE \$5,000 prize offered by Mr. Higgins for the best popular essay on the Einstein theories is awarded to the essay submitted under the title "Relativity" and nom de plume "Zodiaque" by Mr. L. Bolton, of London. This essay will appear in the *SCIENTIFIC AMERICAN* for February 5th, and will be followed in subsequent issues by a number of the other essays of special merit, some in full and others in part.

telegraphic service pay an annual fee, which is fixed at the beginning of each year and is in no case to exceed 25 francs. The money thus raised covers the expense of printing circulars and correspondence. Each subscribing institution pays, in addition, the cost of all telegrams addressed to it. Subscribers are expected to accord to the central bureau priority in the announcement of all discoveries, observations or important calculations, and they are reimbursed for the expense of telegraphing these announcements. Telegrams are sent in cipher. The telegraphic address of the central office is "Astra Bruxelles."

**The Astronomische Gesellschaft.**—A note in *Popular Astronomy* describes some of the great contributions made to astronomy by the Astronomische Gesellschaft, of Leipzig, including the recent publication of the first volume of a monumental 3-volume work on variable stars, which has been in preparation since 1901, and well-known earlier works, such as the 19 volumes of the A. G. star catalogues, the biographical *Vierteljahrsschrift* and *Jahresbericht*, etc. The note goes on to say that, owing to financial difficulties, the Gesellschaft will offer its library for sale, including a complete set of the *Astronomische Nachrichten*. We are told that this is an unusual opportunity for some American institution to get a complete bound set of this valuable journal at a very moderate cost, and that the purchaser "will not only get some advantage from the current rate of exchange, but will at the same time assist the Society in its efforts to keep up its present publications." We should like to point out that there is also an "unusual opportunity" for American astronomers to come magnanimously to the aid of the Astronomische Gesellschaft and save that illustrious organization from parting with its library at all.

## Industrial Efficiency

**The Paris Marche du Monde.**—Due to the support accorded the Paris Marche du Monde by the various countries, the board of directors have decided to alter their original plans. According to a letter received from the director of the American division, the new plans call for 10 stories instead of 6, and a skyscraper tower comprising 35 floors. This tower will be about 60 feet square and almost 500 feet high, and will be the first of its kind ever erected in Europe. It will be devoted to offices for those tenants who do not wish to display their goods. Particulars can be obtained from Milton L. Schmitt, Director American Division, Paris Marche du Monde, Paris, France.

**Turf for Fuel.**—A new method of drying turf to relieve the serious fuel shortage in Finland has been put into operation in various Scandinavian countries. The new method was invented by engineers working under orders from the Russian Soviet Government, to find a more labor-saving method of preparing turf as fuel for the great central power station near Moscow, the process being made known in Finland through an escaping engineer. The fundamental principle of the process is quite simple. The raw turf in the swamp, by a powerful jet of water under a pressure of 20 atmospheres, is freed from all old roots and changed to thin mud. This is pumped out on a drying field and spread in layers. When sufficiently dry it is cut into bricks of uniform size by means of a tractor. The turf pump is constructed like an ordinary water turbine, is reversible with aid of electric motor, is equipped with a cutting apparatus which completes the work of the water jet, and can be raised or lowered as the surface of the mud varies. The entire equipment is mounted on a car which can be pushed forward or backward on rails along the line of work.

**New Tanning Process from Australian Shrub.**—A shrub growing principally in the gold fields of Australia has been found to possess properties suitable for tanning purposes, according to recent reports. Leather tanned by the extracts from this shrub is adjudged equal to the best, being especially useful in lining hats. Some excellent samples of fast dyes have also been extracted from this shrub. An extensive area has been granted the new enterprise by the West Australian minister of mines, over which the company will strip the bush to feed a tanning and extracting works.

**Encouraging Emigration.**—Canadian government representatives have caused a boom in Wales as the result of the emigration campaign. Lectures have been enthusiastically attended by crowds of both sexes, and as a result many farm laborers, domestics and miners, among them many ex-service men, are desirous of leaving immediately for Canada. Nova Scotia asked for 500 miners; the number who offered themselves far exceeded this, and the first parties have left for their new homes. All are ex-soldiers and receive free passages for themselves and their families.

**The Shark Industry** on the Pacific Coast is reported as having developed into an established profession. Shark fishermen are still making good money, and are also making records in big creatures caught. The sharks are what is known as of the "mud" variety, ground feeders at great depth and entirely harmless to human beings. They live in great numbers in the deep inlets of the coast and are valuable for their livers, their skins and the fertilization values of their flesh and bones. At Main Island, on the coast near Vancouver Island, the shark fishermen are catching very large mud-sharks at a depth of 100 and 125 feet. Some of the sharks caught have been 35 feet long.

**Argentina's New Paper Pulp Industry** has been inaugurated with the opening of the first paper pulp factory last September. The mill, which is located near Barranqueras, on the Parana River, is using as raw products a species of bog grass called "paja brava." This grass grows during the whole year, and is so abundant in the swampy places that it has been considered a nuisance. At present the mill is equipped to make only a pulp in sheets and strawboard for paper boxes. It has a capacity of three tons of strawboard per day. The construction of the mill was begun over two years ago during the war. There is undoubtedly a good field for a more elaborate wood-pulp mill in the north of Argentina, since an abundance of trees and plants suitable for paper making exists in that region and there is a market for the product in Argentina.



Left: In order to save concrete, cinders are being used to fill the space up to within a few inches of the steel. Right: The bay at the lock site ready for forms

Two phases of the work on the New Orleans canal

## The Mississippi's Mouth

What New Orleans Is Doing to Insure Its Permanent Navigability

By J. F. Springer

THE Mississippi River is a combination of an asset and a liability. This is particularly the case at New Orleans. Without it, the city would perhaps never have arisen. It serves to put this commercial center upon the sea coast and make of it one of the leading American ports. At the same time, the river is occasionally unruly. It flows in a great arc past the city at an elevation twenty feet above it, and thus becomes a perpetual menace. But New Orleans has never been submerged. This freedom has been secured through the use of energy and intelligence.

In the past few years, New Orleans has attracted attention by the determined effort put forth to extend and develop her facilities as a great port. The new and gigantic repositories for the wharf storage of cotton and the big grain elevator lately constructed are examples. But everything is naturally subordinate to the matter of water connections with the Gulf of Mexico. The natural thing to do is to maintain an open and safe passage through one or more of the distributaries of the great river. Another is to connect with the Gulf by a waterway through Lake Pontchartrain.

The problem of maintaining a passage through an outlet of the river has been agitated for two centuries. There is no difficulty at all presented by the stretch of river extending ninety miles downstream from the city. There is plenty of water both horizontally and vertically. There are three principal outlets from the end of this stretch. One of these, Pass a l'Ouvre, has at the moment no claim of interest. The South Pass is the shortest, but smallest of all, and has been in great use for two score of years. Southwest Pass is a splendid natural waterway except at its terminals, where it is obstructed. It was this route that Eads' first proposition concerned. But Congress insisted upon South Pass and so the great jetties were constructed there. The maintenance of this waterway has been successful though somewhat expensive. It now affords a channel 32 feet deep. But there is a natural advance of the bar due to settlement of sediment. This has been assisted, as we are told by A. E. Washburn, by mud-lump formation. The result is that the approach for ships coming in from the Gulf has been shifted far to the east and has created a difficult turn at the mouth of the jetties. The current maintained and directed by the jetties is, of course, opposed by the body of deep water presented by the Gulf. This stemming of the flood, as it were, serves to form the bar whose crest is now about 2,000 feet from the jetties. On the Gulf side, the slope is exceedingly gentle, being only about 1 in 100. The bar is steadily advancing at a rate of perhaps 75 feet per year and will ultimately obstruct or divert

the mouth of the outlet itself. There is doubt whether South Pass could, at a reasonable cost, be sufficiently developed and indefinitely maintained. Attention has been directed toward the development of Southwest Pass.

Actual construction in connection with this route began fifteen or sixteen years ago. The work has been going on since, but the proposed 1,000-foot channel 35 feet deep has not yet been developed. Formidable difficulties have been encountered. Thus, in the jetty construction at the mouth of the pass, the natural currents in the Gulf are not so favorable as are those at the mouth of South Pass. At times, it has been difficult or impossible to secure sufficient support for the heavy weights that it was desired to impose upon the bottom. The foundation could not be depended upon to maintain its support. What are called "sand waves" have greatly interfered with the development of Southwest Pass. A sand wave is a formation due to the rapid rush and deposition of a large body of sand. Several hundred thousand cubic yards of material may be involved. A shifting of 150 feet in a 24-hour day has been observed. A shoaling up amounting to 20 feet has also been noted as occurring in the same length of time. A "mud lump" is an "exudation of soft clay, caused by the weight of the new sediment which is deposited during the river floods." They frequently occur right in the channel itself. Outside of the channel mud lumps may attain considerable heights. Thus, they may rise to levels 9 or 10 feet above the river surface. Equilibrium will eventually take place because of the increasing weight of a developing mud-

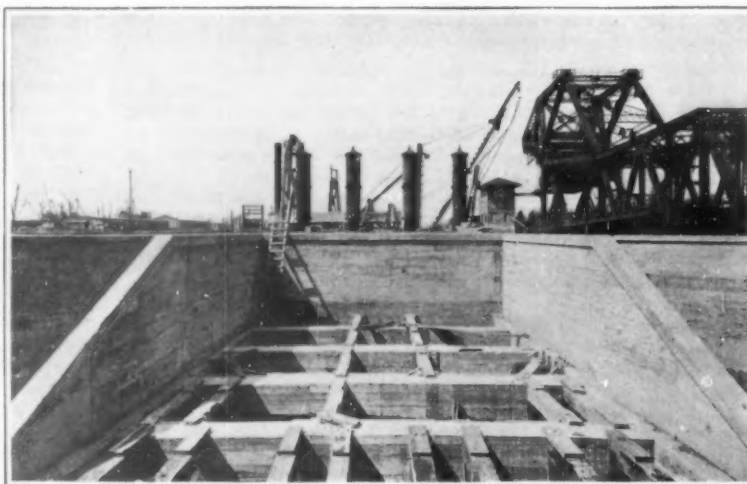
lump. The levels named, however, show how far the process may go before a balance is attained.

New Orleans is, however, not content with the developments of South and Southwest Passes, but is rapidly putting through a canal scheme. The Inner Harbor-Navigation Canal will connect the Mississippi River and Lake Pontchartrain by a waterway 5 miles (28,000 feet) long. This canal passes through the city itself. When the Board of Commissioners of the Port of New Orleans have completed this great undertaking, there will be in the city ocean docks fronting on deep and quiet water subject to a very small tidal fluctuation. On the river front it has been found practically impossible to maintain piers projecting at right angles to the current of the river, because of the rapid sedimentation of the small basins thus created. Ships have to lie alongside wharves parallel to the river or stand out in the stream. The new additions to harbor facilities will provide very still water. The water level in the lake varies 6 feet, while that in the river varies 19 feet, both from the same minimum. The canal level, except at the river end, will vary with that of the lake. To effect a junction with the river, a big lock is being constructed. The canal depth will be 30 feet. At the bottom, the width will be 150 and at the top 330 feet. The lock is to be long enough to receive a vessel 640 feet in length and it will have a width of 75 feet. Four lift bridges will enable the canal to be crossed at as many points. One of these is located at the lock and is, in fact, carried by the lock's substructure. Then there is the big siphon which provides a passage for one of the principal drainage out-

lets of the city. The lock begins at the terminus of a 2,000-foot section of the canal located at the river end. It forms part of the line of the canal. The canal section next the river will naturally be subject to the floods of the stream. It is accordingly necessary to continue the river levees along both sides of this part of the canal. These are to have heights of 23 feet above low water. There will thus be a margin of 4 feet between the river level in this part of the canal and the top of the earthen wall. Briefly, the canal will consist of a 2,000-foot stretch forming a side projection of the river and a 25,000-foot arm of the lake, with a short intervening transition section.

The land in all this region consists of river silt; so that the usual problems of rock excavation do not require solution here. But a novel situation arose because of the fact that the route runs through an old swamp forest. Beneath the root mat of this forest are the stumps of another and older one. From the surface to a level 15 feet below, the stratum consists of an intermingling of stumps and

(Continued on page 97)



Details of the siphon that provides a passage past the canal for the city's drainage. In the background are seen the gate valves and one of the canal bridges

## New York's Snow-Fighting Tractor Plows

By Alfred Longville

**D**URING the month of February, 1920, traffic tie-ups due to unexpected blizzards cost the merchants of New York City some sixty million dollars, and the city itself five and one-half million dollars for emergency snow-removal work. Although the Department of Street Cleaning did everything that could be expected of them, their equipment was inadequate to handle the situation, and outside contractors were called in. These contractors failed the Department at the critical time.

Horse-drawn snow plows and motor trucks were of limited use only against the deep snow drifts. None of the equipment owned by the Department, or available outside, was able to handle the heavy fall and packed snow, except a few small tank-type tractors which had been voluntarily offered for the work. Tractors of this type were found equal to the task.

The Department of Street Cleaning has maintained in the past, and still does, an Engineering Bureau which tries out and tests all kinds of street-cleaning appliances. After the costly experience of last winter, the city officials and business men of New York concluded that the city could not again afford to be snowed under and that special measures were necessary.

A Snow-Removal Committee was appointed by Mayor John F. Hylan with Fire Chief John Kenlon as chairman. This committee was to report to the Mayor on ways and means of handling the snow in the most efficient manner. Chief Kenlon, basing his plans upon successful fire-fighting experience, decided that it was imperative to have motor equipment which could be kept at work throughout the storms so that it would be necessary to clean up but a small part of the snow when the storm was over.

The Snow-Removal Committee, working on this basis, organized a series of tests during the month of July. All manufacturers of track-laying tractors were required to compete in this event, a committee having already decided that the track-laying type was the only type able to handle the snow under extreme blizzard conditions. Sand was spread thickly on the pavement in the place of snow and the tractors equipped with push plows were required to demonstrate their ability to work under "blizzard" conditions.

From the results of this demonstration and investigation, the specifications for the machines were written. The Committee on Snow-Removal having accomplished its purpose, it was superseded by a committee for the purchase of snow-removal equipment, headed by Mr. Grover A. Whalen as chairman. Mr. Whalen is also chairman of the Board of Purchase, and Commissioner of the Department of Plants and Structures. This committee decided on the purchase of one hundred small tank-type tractors, fifty large crawler type tractors, and a big fleet of trucks with dump bodies, together with the necessary push plows for the tractors. The one hundred small tank-type tractors are equipped with winter tracks, a covered cab, a two-man seat, storm curtains and sirens. One of the small tank-type tractors appears in the illustration at the top of this page. The powerful engine of this tractor, together with the heavy tractor belt provided with special cleats for work in snow and on ice, insures proper operation of the adjustable push plow.

Last winter, during the blizzard which not only tied up New York but many other cities, the small tank-type tractor had many opportunities to prove its ability to keep roads and streets clear when all ordi-



Small tank-type snow plow adopted by New York City for cleaning its streets during blizzards

nary methods failed; and no doubt there are many municipalities still using horse-drawn equipment on snow plows and scrapers, which will follow New York's



The motor sled can cross a narrow chasm or brook by means of felled trees, because of its powerful tractor belt

lead and install automotive equipment to solve their snow-cleaning problems. For New York's decision was based upon successful performance under the worst



Testing the Horner motor sled under actual conditions, showing the location of the driver's seat and the driving wheels and traction belts

conditions experienced in many years and upon severe tests which have substantiated this performance in every way.

## The Motor Sled Versus the Dog Sled

By George Gaulois

**L**ITTLE is required by way of introduction to this story. Of late the newspapers have devoted sufficient front-page space to the experiences of our three Naval balloonists in the frozen wilderness of northern Canada to give us all a pretty fair idea of what traveling means in snow-bound lands. The slow and laborious trip of Lieutenants Kloor, Hinton and Farrell from Moose Factory to Mattice, with their snow shoes and dog sleds, cannot fail to impress us with the stern necessity for better means of travel over snow.

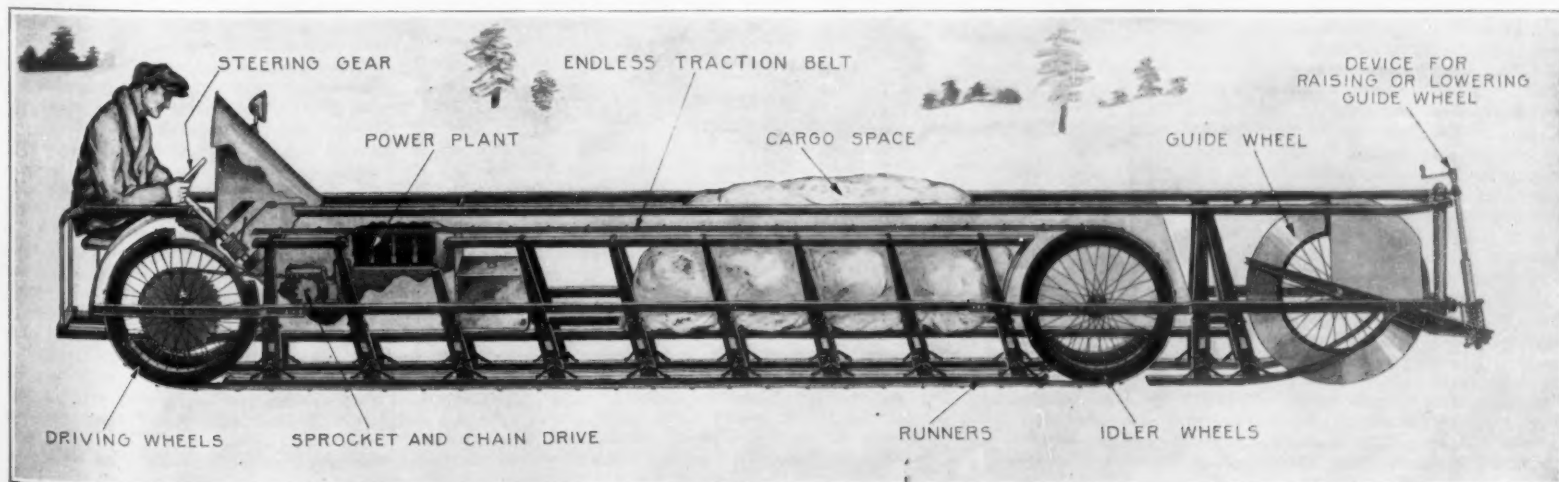
Long before the above-mentioned incident, Frank G. Horner of Ruby, Alaska, set to work developing a suitable motor sled that would take the place of the primitive dog sled. First-hand experience with the many difficulties incidental to traveling over soft snow and broken ice, as well as an exhaustive engineering study of the problem, led to his development of the motor sled which forms the subject of our present cover illustration. In the words of Horner, his object has been to provide a motor sled which may be used for transporting goods and passengers over the snow, especially in those northern countries where traveling is done largely in winter by means of dog sleds.

As will be noted in the drawing below, the Horner motor sled has a frame consisting of the top members which extend from the front to the rear of the machine on each side. This frame is preferably composed of hickory wood. Beneath the upper members are longitudinal frame members which terminate short of the top members, as indicated. Midway between top and bottom of the sled and on each side are longitudinal frame members. Then there are brace members disposed along the sides of the sled and inclined to the rear, the purpose being to provide a construction which will take up the thrust encountered by the runners without danger of so racking the sled as to cause it to break to pieces. Another interesting feature is that certain members are connected to each other by means of rawhide tongs, for the reason that the inventor has found by experience that this form of connection is preferable to a rigid construction. The latter, if it is made of metal, tends to crystallize and will eventually break.

So much for the main frame. Secured to the bottom of the struts or brace members are the runners, which, it will be noted, do not run the full length of the machine. The forward and rear ends of each runner are curved upwardly. Each runner is provided with a central longitudinal groove, and between the groove and the edge is a metal shoe.

A pair of driving wheels are mounted at the rear of the sled. Toward the front of the machine is a pair of idler wheels. A pneumatic tire is applied on each wheel; but the tire in this instance is somewhat out of the ordinary, in that it is thicker and has a flat outer surface which is grooved. Arranged to extend over each drive wheel and its corresponding idler is an endless belt which is made preferably of steel tempered so as to pass around the wheels without being permanently set or bent. Secured to one side of this belt is a series of cleats.

The motor sled is so constructed that it is not damaged by coming into contact with rocks or logs or other obstructions. Furthermore, being somewhat like the caterpillar tractor in its method of locomotion, it can cross narrow chasms, brooks and other declivities alone or with the aid of felled trees, as shown in one of our illustrations.



Details of the Horner motor sled which has been developed with the idea of encountering all conditions of snow travel and replacing the present dog sled

## Power in Big Packages

Some of the Economies to which We May Look Forward if We Pool Our Fuel-Burning Plants

By S. G. Roberts

A YEAR back, the estimates presented by Mr. William S. Murray, originator of the superpower zone project, startling as they were, as evidence of prevailing wastefulness, were conservative; but the figures arrived at in the meantime reveal more than ever why it is well-nigh imperative that the superpower zone become a fact at the earliest practicable day. It is indisputably plain that great benefits can be reaped by the pooling of electrical energy through the inter-linking of an array of highly efficient central stations. And it is equally clear that the isolated plant is no longer to be encouraged unless it is of a character that will warrant its operation as a unit in the superpower equipment.

The scope of the superpower zone has been somewhat amplified since the inception of the project. The present boundaries include the southern sections of New Hampshire and Vermont, and more of New York, Pennsylvania, Maryland, Delaware and New Jersey than at first contemplated. Pretentious as this sounds, the land area involved is only two per cent of that of all our states. Within this region lives 22 per cent of our population, and these people, with a little more than a third of the nation's developed mechanical energy at their command, produce in value 40 per cent of our manufactured articles. This is interesting inasmuch as we see that this section of the country may quite properly be compared industrially with the British Isles which, also, are really a vast finishing shop and draw from elsewhere the bulk of their needful raw materials.

The American worker has hitherto held his own in competition with the cheaper labor of Europe by reason of the automatic apparatus and the machine tools put at his disposal; and probably nothing illustrates this more strikingly than the difference in horsepower back of the wage earner in this country and in the United Kingdom. Here, taking the worker at large, he has had to help him 2.6 horsepower as against 1.5 horsepower of his British fellow. A decade back the corresponding value of the products per wage earner per annum was \$2,950 for the American and \$1,300 for the Britisher. Again, limiting the comparison to the workers living within the contemplated superpower zone, the native wage earner has had 4 horsepower to aid him in turning out his wares, and the value of his products has been \$3,700 in the course of a twelvemonth.

Simple arithmetic shows how vital to our industrial well-being is an ample supply of motive energy; and if we are to be in a position to compete in the markets of the world it is imperative that we continue to furnish our array of labor with as much horsepower per capita as in the past, if not more. But we cannot do this and maintain the same economic lead unless we make it feasible to develop the power at a lower cost. That is to say, do here just what so many of the leading nations of Europe are taking radical steps to accomplish through a wider application of electricity and the generation of current along the most approved lines.

Our electric utilities in the superpower district burn, commonly, only a little less than 3 pounds of coal per kilowatt hour, and the power plants of isolated manufacturing establishments consume on an average 8 pounds per kilowatt hour—some of them actually squandering 18 pounds. The fuel for this service is, for the most part, moved from the mines to the points of use by the steam railways; and an analysis of their operation brings out the fact that these common carriers, for the equivalent of a kilowatt hour, make away with something like 7½ pounds of coal. We have substantially

LAST June we printed an article dealing with the economic possibilities of the superpower plan proposed for a section of the northeast Atlantic seaboard. Subsequently, Congress made available \$125,000 to be used under the direction of the U. S. Geological Survey in carrying on certain investigations preliminary to the adoption of the scheme as originally outlined by William S. Murray; and private interests of various sorts have patriotically contributed to promote the thoroughness of the studies in hand. After something like nine months of active inquiry and the co-ordination of a wealth of data, Mr. Murray and his associates of the superpower survey have reached positive conclusions of the utmost value, which we present in this article.—THE EDITOR.

9,000 locomotives threading the rails inside of the section under discussion and because of the fuel needs of these engines, fully 13½ per cent of the tonnage hauled by them brings in no financial return. One of the purposes of the superpower plan is to relieve the railways of this incubus. The means to this end will be the complete electrification of one-fifth of the 30,000 single-track miles of trunk line roads. The density of traffic on the remaining 24,000 miles is not yet sufficient to warrant supplanting the existing steam traction.

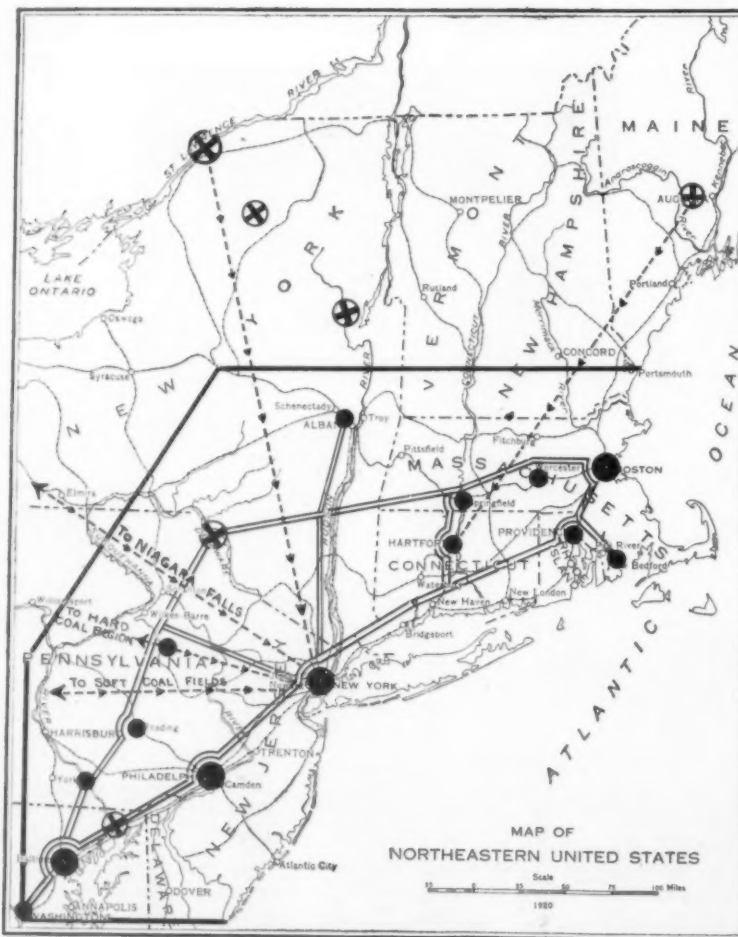
In the year gone our mines yielded a total of 646,000,000 tons of both bituminous and anthracite coal, and we should bear in mind that one-third of the coal burned in the United States is consumed within the so-called superpower area. This gives us some idea of

effect this by materially cutting down their fuel consumption. That is to say, the lines that should be electrified handle at present 14,000,000,000 ton-miles, and ten years hence they would be expected to take care of 175,000,000,000 ton-miles, such being the burden industrial expansion would lay upon them. The present power station capacity of the electrified divisions aggregates 120,000 kilowatts, and by 1930, if the electrification scheme be adopted, the total central station capacity will be augmented to 1,370,000 kilowatts. Inasmuch as the improved central stations will be able to develop a kilowatt hour for 1.7 pounds of coal, and can distribute within a radius of 150 miles from the source of generation large blocks of energy at a loss of only 5 per cent, there is little reason for wonderment in the claim of the technicians that it will be possible at the start to reduce the annual consumption of coal in the superpower zone by 30,000,000 tons, if not more.

One impressive revelation, following the investigations of the experts of the superpower survey, is the large measure of time that existing power installations are either idle or running at a low percentage of their capacities. They represent heavy initial outlays, an immense sum taking them in the aggregate, and they constitute an overhead that must be allowed for in the distribution of profits and losses. Theoretically, this equipment should be run continually and thus pay promptly for the initial cost, and thereafter, so long as fit, become a source of revenue. This, unfortunately, is far from being the case; and the worst of the wasters are the power plants of isolated manufacturing establishments. From the data at hand, it seems that out of a year of 300 working days, for example, the prime movers are operating only 18 per cent of the time. However, if the energy needed by these factories, mills, shops, etc., were furnished by the superpower system, the generators of the latter could be run at full load for sixty per cent of the period mentioned.

This arrangement would stimulate tremendously the output of commodities, bring in a handsome return upon the power installations, and actually provide a far bigger volume of motive energy while burning annually less fuel by millions of tons. Taking the superpower zone in its entirety, the present total power consumption is approximately 27,000,000,000 kilowatt hours, and, if the normal rate of traffic and industrial expansion continue, the energy demand in 1930 would amount to 50,000,000,000 kilowatt hours. With the superpower zone system in action, nine years hence the inter-linked electrical trunk lines should be able to take care of three-fourths of this stupendous load. Our central stations now meet an energy demand of 12,000,000,000 kilowatt hours, and by 1930 they should be equal to an energy demand of

(Continued on page 97)



Diagrammatic plan showing trunk-line circuit and possible sources of power lying outside the superpower area. The circles enclosing crosses indicate points at which may be established large hydroelectric plants. The solid dots show approximately where stream turbo-generating stations would be situated. Observe that Niagara Falls and the hard and soft coal regions of Pennsylvania are near enough to transmit electricity from central stations located there.

The super-power zone as now planned

# A Matter of Definition

Divergent Viewpoints as to What Constitutes a "Popular" Essay

By the Einstein Editor

ARISTOTLE it was, to the best of our halting recollection, who first pointed out that all argument reduces to disagreement over definitions. If we could but agree as to precisely what it is that we are talking about, and precisely what we mean by every statement we make about it, there would be little room for contradictory opinions as to the truth or falsity of these statements. If we may revert to the terms of our recent geometrical discussion, it stands to reason that argument must be mainly confined to the question of what we shall assume to be true; once having set up and agreed upon a categorical set of assumptions, it is indeed a rare case where the consequences do not follow with sufficient definiteness and certainty to preclude controversy. There is then nothing left to argue about.

This point is strongly driven home by examination of the essays submitted in competition for the Einstein prize. When a man competes for a sum of this size, it may be taken for granted that the product of his pen represents his best conception of the thing asked for. When he discusses to the extent of 3,000 words such a subject as the Einstein theories, without committing any material offense against scientific accuracy, he has presented good evidence that he is a person whose opinion is of some weight. Yet between the various contestants who submitted scientifically competent essays there existed a disagreement as to what constitutes a popular essay, so wide as to inspire us to the present discussion.

We must after all define the essay by defining the audience. Just how much scientific knowledge are we to assume on the part of "the lay reader," "the person with no special mathematical training," "the normal man of intelligence," etc.? This very question, one of our contestants reminds us in his introductory paragraph, was put to no less an authority than Faraday, just prior to one of his public lectures; and the great popularizer of science replied decisively "None at all." If Faraday were with us today, he might find it desirable still to answer the question in the same way. But times have changed greatly in a century, and we seriously doubt that he would take so extreme a viewpoint.

## What Does a "Layman" Know?

Faraday lectured to earnest young men who were using his talks as a means of making a first acquaintance with scientific matters. In the absence of the funds and the social standing necessary to see them safely into one of the universities, public lectures of the sort he delivered were the only means of instruction in science open to these aspirants. Under such conditions, Faraday was necessarily talking to men who knew nothing of science; that was why they were there before him. But today, with our enormous press, our vast system of public libraries, our processes of ordinary education so much more general and so much more effective than a century ago, our procedure whereby anyone can have a higher education who wants it enough to work for it, we have created a reading public with a degree of general scientific background never before approached. In attempting to meet the scientific curiosity of the layman we no longer need feel obliged to go all the way back to the beginning to meet him; we may be assured that he can come part way to meet us.

In the mind of anyone who has ever given instruction of any sort, in any place, there will inevitably here arise the uneasy query: "Yes, he can. But will he?" In any group of students there will always be a certain proportion whose attitude is a puzzle. For some years I have been teaching mathematics in the evening courses at Columbia. With due exceptions, the student body in these courses is composed of men and women who work during the day, and who are taking advantage of the opportunity to get a college or an engineering education at night. Necessarily this means that for the eight months of the college year there is practically no leisure; life is a continuous round of work and college. It would seem as though these were conditions calculated to freeze out every student who was not in deadly earnest. Yet in every class one finds a few students who come night after night without

the least preparation, who never so far as appears make the slightest effort to assimilate the instruction put before them by the text and the instructor—who display an outlook upon the work of the course which seems the height of absurdity in one who goes to school at such great inconvenience.

## Empty Buckets and Empty Heads

I think the answer lies in a failure of the immature mind to comprehend just what instruction consists in. I am rather well convinced that it is not through deliberate design that the student assigns to himself a rôle analogous to that played by the bucket in the drawing of a gallon of water; but that it is through sheer non-comprehension of the necessities in the case that he looks to the instructor to pour knowledge into his unresisting but unassisting mind. Of course it cannot be done that way; but the student in many cases never discovers this. And much of the reading of "popular" articles on science and other serious topics which I see impresses me as being done in this very state of mind. The reader would be highly indignant if we were to characterize him as illiterate; but this in effect is what he is. He has acquired a trick of following the printed word with his eye while closing his mind to its implications and above all to its demands. If we hit him over the head with a rhetorical black-jack, if we drive home a point with sledge-hammer force behind a happy phrase, he will perhaps take in what we say; if we demand the least degree of independent exertion on his part he will slide gayly over the surface and report that he has been quite unable to make out what we are talking about. And no writer can make every sentence a sledge-hammer, nor

## Beginning at the Beginning

In the realm of science the situation is the same. I have a certain knowledge of mathematical analysis and the foundations of mathematical theory, acquired at the cost of some six years of close attention to these things in undergraduate and graduate work. I do not deny to any person of normal intelligence and proper willingness the ability to duplicate this knowledge. But is it unreasonable for me to feel that if it took me six years to gain whatever mastery of the subject is mine, the next fellow may fairly be asked to spend as long in covering the same ground? Am I not justified in feeling that certain items, representing largely the climax to which the work of six years has led, are of such a complex and special nature that it is rather hopeless for me to attempt to tell you anything about them until you have followed me through the prerequisites?

Do not misunderstand me: I would not support the notion that science is a hereditary oligarchy, to which only the elect may aspire. I would not stand at the door of science and deny admission to anyone; I would merely make him show his ticket, or, if he had none, go and get one. And it would be necessary for me to take this stand, because offense here comes from both sides. The over-ambitious writer attempts to put before his popular audience things which are fundamentally unfitted for that audience in its present state or in any state it can soon acquire; and, on the other hand, the over-ambitious layman demands to be informed about this, that and the other thing which he has not the foundation for understanding. To a gentleman who recently questioned my statement that there really were things which the lack of preparation of a layman

prevented us from presenting to him, I suggested the differential equation as a sample of this sort of thing. I never saw an effort to explain to a layman what such an equation means, and I have no idea that such an attempt would ever succeed. Before we can talk a language we must acquire the vocabulary. And it disgusts me excessively when a man to whom geometry is such a closed book that he has not the slightest notion what I mean when I speak of proportion asks to be told what a sine or a cosine is. I can tell him what trigonometry is about, what it does and to a considerable extent how it does it; but he will have to go back to school before I will undertake to mention a sine in his presence.

Most people I find are inclined to be reasonable about this sort of thing.

When they are not so inclined they must have reason forced upon them. And the success of a popular essay on any scientific subject depends in very large measure upon the degree of judgment shown by the author in deciding just how far he may safely go into his subject. He has got to go far enough to make it seem worth while; he must not go further than his audience is equipped to follow him.

## Ideas and Their Labels

Much the same remarks may be made with regard to the actual language employed as to the matter covered. The simplest thing can be talked about with sufficient polysyllabic profundity—or perhaps pseudo-profundity—to make it unintelligible. When we attempt to define the vocabulary of the "average reader," however, we encounter far greater difficulties than when we try to delimit his scientific horizon. But there is one point on which I have the strongest feelings. Names are made to use. Every word in the language, from the simplest to the most technical jaw-breaker of them all, exists because it represents a thing or an idea which, in the absence of this word, would have to be named at greater length than is necessary when we have the word; or perhaps even described in considerable detail. On meeting a new person the first thing we learn is his name; and unless we be one of those exasperating folk who can go through an introduction with all the outward manifestations of correct form but without paying the least attention to the other fellow's name, we at once proceed to employ that name in speaking to or of him. Before the introduction it was the tall, handsome gentleman in the brown

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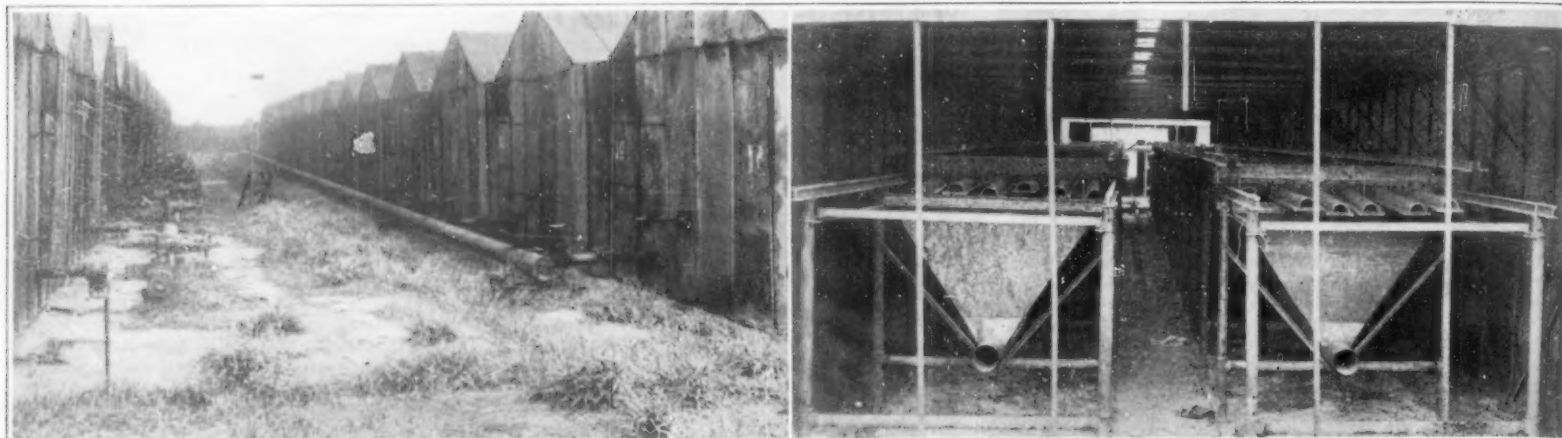
**WE ARE** not going to apologize for the Einstein award—we make this bald statement lest the article on this page look like an effort to do this. We are sure that when it appears next week, the winning essay will silence all critics who await it with the suspicion that it is not going to be properly popular. We are not even going to apologize for some few of the essays which, in recognition of their intrinsic merit, we shall later print in spite of the fact that they are not in all respects what we feel that a popular essay should be. On this page we are merely stating an academic question, suggested by the contest, which seems to us one of interest; and answering it in a manner which seems to us reasonable, and which we hope will seem to our readers interesting.—THE EINSTEIN EDITOR.

could any reader stand up under the repeated concussion if it were possible for the writer to sustain this pitch.

Perhaps, then, we have made progress. Perhaps we may agree that the popular essay is aimed at the reader who will contribute his bit to its intelligent reading. Then we have to define our audience by agreeing just how much it may fairly be asked to contribute. Just what equipment of scientific ideas and of specific scientific knowledge may we fairly demand of—well, let us say of a man who, by his desire to know what the Einstein theories are about, implicitly claims the ability to take up this information.

We may profitably bear down upon this question from the negative side first, and narrow the issue by stating a few of the things which it is not fair to demand.

We must before all else beware of presenting to this man material which not alone is he unequipped to take in, but which it would be unreasonable to expect that he would ever equip himself to take in. There are certain lengths to which we can profitably go in search of new knowledge, and others to which we individually cannot with profit go. If you insist on having it, you may get training in automobile construction which will qualify you to take your car completely apart and put it together again. But at less exertion you can learn everything you need in connection with anything that is ever likely to happen to you on the road. You will profitably leave complete knowledge of automobile assembly to the man whose business it is to assemble automobiles. In any event, if you try to duplicate his knowledge, you will find that it takes a lot of time—probably more time than you have to give.



Left: Carbon black "burning" buildings, showing gas mains and connections. Right: Interior view of a burning building in which air-cooled scrapers are used instead of the channel-iron variety  
Inside and outside the buildings in which natural gas is burned into carbon black

## Where the Printer Gets His Ink

### America's Carbon-Black Industry and the Methods It Employs

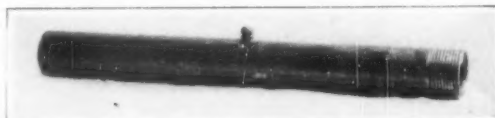
By Henry P. Westcott

**C**ARBON black is a pure, flocculent form of carbon which is manufactured from natural gas. It is made by burning gas under very low pressure in a low flame with not enough air admitted to produce complete combustion. The result is that the unconsumed carbon is deposited on a roller or plate, from which it is removed by an automatic system of scrapers and conveyors. Carbon black is then bolted or sifted and is packed by special machinery. It is a most curious substance, for when first scraped from the plates it is so light that 30 pounds of it are sufficient to fill a sugar barrel; the specific gravity of carbon black, however, is about 1.7, so that it is really very much heavier than water; therefore, 95 per cent of the bulk of black as it comes from the plates is really air, and the problem of packing is to separate the black from the air so far as is commercially feasible.

The first carbon black was made and sold in this country in the year 1864 for use in the manufacture of printing ink. The original process, which seems to have been invented by J. K. Wright, was applied to artificial gas. The process was satisfactory but the cost of the product was too great. The growth of publications in the United States required an abundant source of carbon black so that ink could be produced at a moderate cost. Natural gas furnished an ideal solution of the problem and carbon black is now made on a large scale from natural gas in West Virginia and other states and is a staple commodity which is used in the manufacture of printers' ink, automobile tires, paints for metals, for carbon paper, typewriter ribbons, phonograph records, tarpaulins, carriage cloth, black leather,

paper, bookbinders' boards, shoe polish, stove polish, electrical compositions, in cameras, and in making crayons. This is certainly a very diversified use for a primary product. There are, however, two other blacks which also have their uses, but are expensive. We are referring to what is known as "lamp black," which is made by burning tar oils or creosote. Another form of black is made from the burning of the bones of animals. This is called "bone black."

Carbon black, or any black possessing the same properties or adapted to the same variety of uses, cannot



The natural gas is burned at tips quite similar to those used in house-lighting

be commercially manufactured from any other material than natural gas, artificial illuminating gas being out of the question as a commercial operation on account of the low yield and the prohibitive cost. Of course, the great use of carbon black is in the manufacture of printers' ink, but its use in rubber tires is also enormous. It conserves rubber by lengthening the life of the tire.

The main point to consider in locating a plant, outside of the proximity to the supply of natural gas and railroad facilities, is to locate it in a depression or gully

where it will be least affected by the prevailing winds.

The burning of the gas requires a certain amount of draft, but the flames must be protected from all unnecessary drafts and especially from high winds, otherwise the losses would be entirely too large. Carbon black is very light and under the most ideal conditions a large percentage is carried off by the burnt gases and is lost.

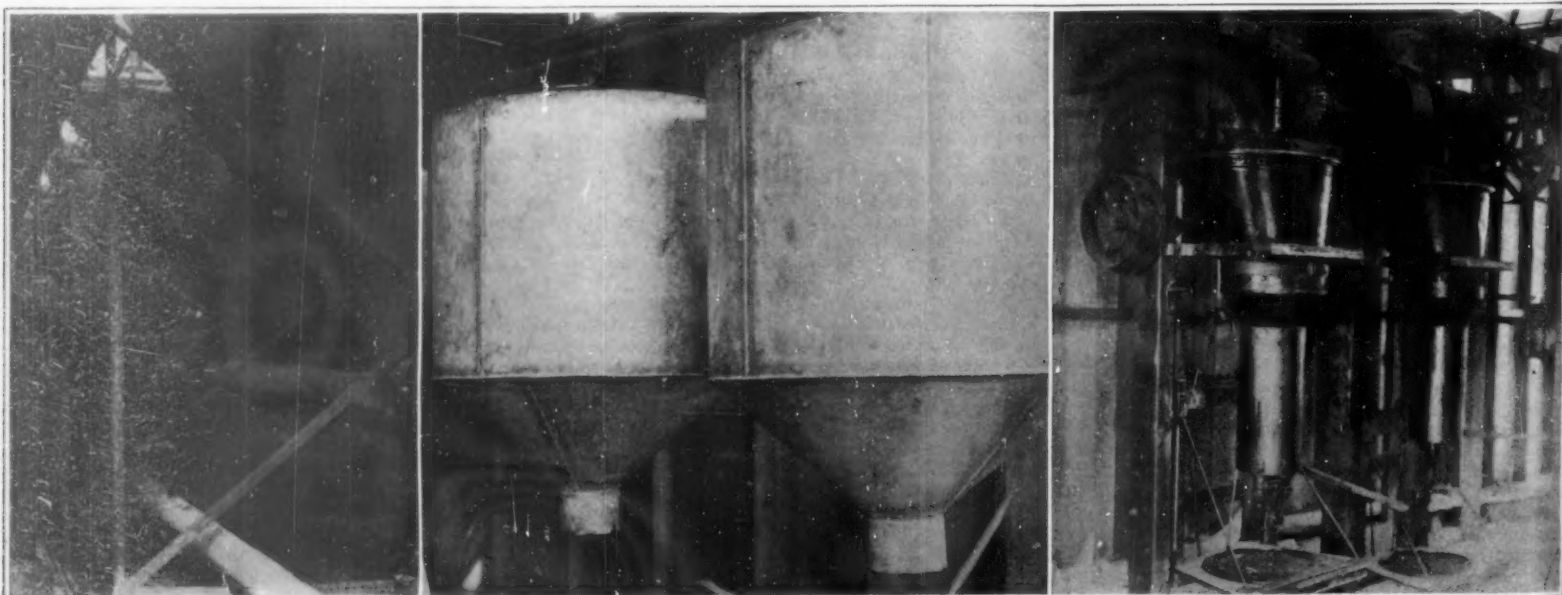
A carbon black plant generally consists of twenty to thirty "burning" buildings, a bolting and packing building, power plant and necessary warehouse for storage of the finished product.

The capacity of a thirty-building plant is dependent upon the constituents in the gas, as the greater the percentage of heavy hydrocarbons in the gas the greater the yield of carbon from 1,000 cubic feet of gas. At one thirty-building plant the writer visited the production was approximately 4,500 pounds per day. This plant was burning natural gas of about 0.61 specific gravity, hence very low in heavy hydrocarbons. This plant consumed during the twenty-four hours about five million cubic feet of gas and made one pound of carbon from 1,100 to 1,200 cubic feet of gas.

In West Virginia the production of carbon from a similar sized plant with much heavier gas—.76 specific gravity—would run over 6,000 pounds per day from the same amount of gas. In other words, with gas of this gravity it would require from 750 to 800 cubic feet of gas to make one pound of carbon black.

The burning buildings are constructed entirely of

(Continued on page 99)



Left: A general view inside the building where the burning is carried on. This view, dim as it is, is quite realistic. Center: The blockers, or sifters. Right: The automatic packer  
Some of the apparatus of the carbon-black industry, which furnishes this ingredient to makers of printers' ink

### A Brake for Every Wheel

IN the matter of improved brake design for automobiles, it appears that European manufacturers have little to learn from us just now. If anything, they are showing us the way to more efficient braking. The latest improvement abroad takes the form of a brake construction for all four wheels, replacing the usual type of brakes for rear wheels only, used in most automobiles.

However, an American inventor has recently come forward with a new and simplified four-wheel brake construction on which he has obtained basic patents in the United States. An accident while driving showed this inventor the dangers of skidding, and careful investigation led him to believe that the usual brakes are at the wrong end of the automobile.

It has been found in tests that a car equipped with a four-wheel brake system of the general design shown in the accompanying illustration was able to stop in the following distances:

At 10 miles per hour, in 3 feet.

At 20 miles per hour, in 9 feet.

At 30 miles per hour, in 20 feet.

With the same type of car equipped with the usual type of brakes it required a space of 83 feet to stop the car at a speed of 30 miles per hour, or almost four and a half times the distance required with the same car equipped with four-wheel brakes.

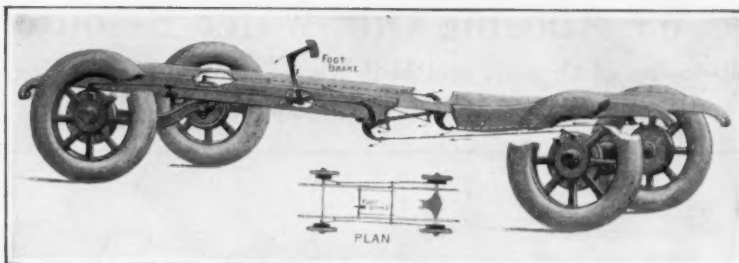
In recent experimental brake tests by competent engineers it has been demonstrated that a touring car with all seats occupied carries the greatest load over the rear axle. At the instant when the brakes on the rear axle are applied the load is transferred to the front axle, due to the reaction of the brakes on the rear brake drums. This is said to be the principal cause of skidding. With the brakes applied at the same time on both front and rear axles, the tendency to skid is said to be entirely overcome, and a much quicker stop can be made. Traveling over a wet pavement at a speed of 20 miles per hour, the four-wheel-brake car can be stopped within its own length. It can round corners at faster speeds than are usually considered safe with wet pavements, because of the excellent control. In congested city traffic the four-wheel brakes make the handling of the car an easy matter.

This system of four-wheel brakes can be applied to any standard car with but few changes and in a short space of time.

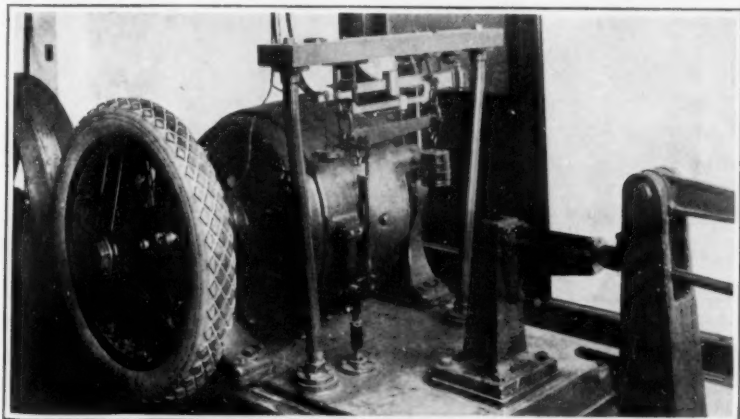
### Tire Tolls on the Car Engine

A SPEED limit of 20 or 25 miles an hour may obtain on the National highways, but the maximum speed of 50 miles an hour—the limitation of the apparatus itself—alone governs the operation of special equipment installed by the Rubber Section of the Bureau of Standards, for determining the power loss or energy absorbed by varying types of automobile tires. The conditions of travel to which automobile equipment is subjected in actual use are duplicated in this government laboratory where electrical absorption dynamometers are being applied in a new rôle of usefulness.

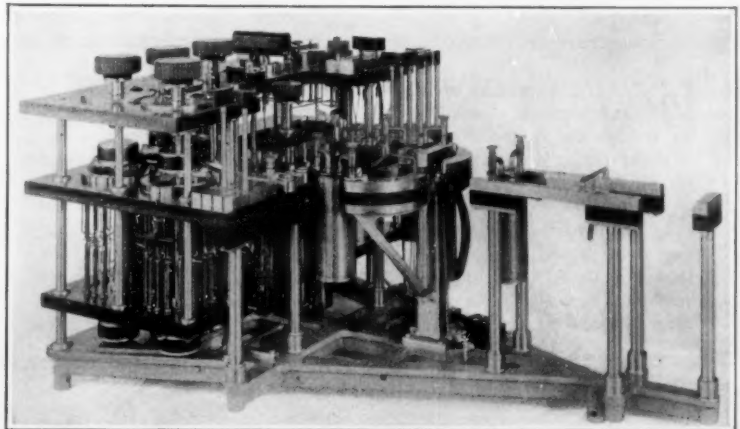
The set of dynamometers, as installed for testing automobile tires, consists of a motor element which carries on its shaft the tire to be tested, and a generator element carrying a drum which is driven by the tire. The arrangement is such that any desired pressure may be exerted by the tire against the drum, any specified speed measured in revolutions per minute or their equivalent in miles covered every 60 minutes may be secured, and the tractive effort or driving force exerted by the tire on the road surface may be varied and controlled by the operator. The capacity of the dynamometers is 20 horsepower when operating at a speed of 50 miles an hour.



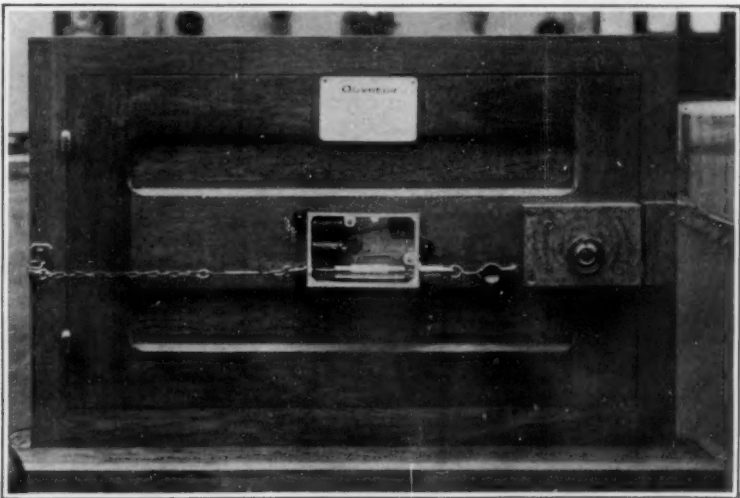
Numerous advantages are claimed for this four-wheel brake system which may be applied to any automobile. Operation of the foot brake applies all four brakes because of the "S" shaped levers, which also take up slack



Apparatus for determining the power loss of automobile tires, or the energy dissipated in heat. This equipment is also adaptable in studying the effect of the fillers on the life of pneumatic tires



Precision resistance bridge with oil immersion, the temperature of which is automatically maintained constant. This bridge measures resistances from .0001 to 10,000 ohms with one-thousandth per cent accuracy



Simple mechanism which controls the locking of a door from a distance by an electric circuit. A powerful spring in the center box unlocks the door and swings it open

The object of the laboratory experiments is to measure the power loss or energy dissipated in heat. Likewise, the special apparatus is adaptable in studying the effect of "tire fillers" on the life of pneumatic tires, and on the power absorbed by tires thus filled as compared with that consumed when inflated with air. The relative merits of each will be determined according to scientific conclusions based on the results of comparative tests.

### Where the Ohm Comes From

BATHING beaches are extremely popular and summer resorts are prosperous amid the seasonal influx, but you would hardly think of an electrical testing apparatus operating most advantageously in an oil bath. And yet one of the novel features of a new precision resistance bridge designed and constructed by the U. S. Bureau of Standards functions in oil the temperature of which is automatically maintained constant.

Electrical resistance standards as tested for Uncle Sam, State governments, public service commissions, corporations, manufacturers and even individuals, require accuracy from very low to extremely high values, ranging from one-tenth-thousandths of an ohm to 10,000 ohms. An essential feature of the duties of the electrical resistance laboratory of the Bureau of Standards is the maintenance of the unit of resistance, one of the fundamental units upon which measurement of electrical power is based. Hence the construction of this novel resistance bridge which is capable of making measurements with a degree of accuracy of one part in 100,000 or to one-thousandth per cent.

The apparatus can be used as a simple wheatstone bridge for resistance of one ohm and above or as a double bridge for resistances below one ohm. The bridge is operated in oil, the temperature being automatically kept constant. Apparatus for testing of electrical resistance standards, in order to insure best results, requires a mechanism of special design and constructed of the choicest material. Consequently, both the resistance bridge and galvanometer were designed and built by the Bureau of Standards for the specific work to which the units have been dedicated.

### Something New in Electric Door Openers

FROM France comes the unique electric door opener which forms the subject of the accompanying illustration. This device serves not only the same function as the usual electric door lock, which releases the lock upon the pressing of a button at a distance, but it also swings the door open. Its installation is simple, as will be noted. What is more, but less obvious at first glance, is that the mechanism is such that it does not readily get out of order.

In brief, the new electric door opener comprises three main members, viz., the lock proper, the electric mechanism, and a chain connecting the lock and the mechanism together, as well as the mechanism with the anchor on the frame of the door. Normally, the tongue of the lock is held closed in the usual manner. A helical spring in the little box mounted in the center of the door is prevented from pulling back the tongue of the lock by an engaging lever. However, when electric current, controlled by a push button or other desirable means, flows through a pair of electromagnets mounted in the little box, the engaging lever is attracted and swings out of engagement with the rod under spring tension, thus operating the lock and, by virtue of a powerful helical spring, causes the door to swing open. The device is automatically reset when the door is swung closed again.

## Are We Abusing Our Water Resources?

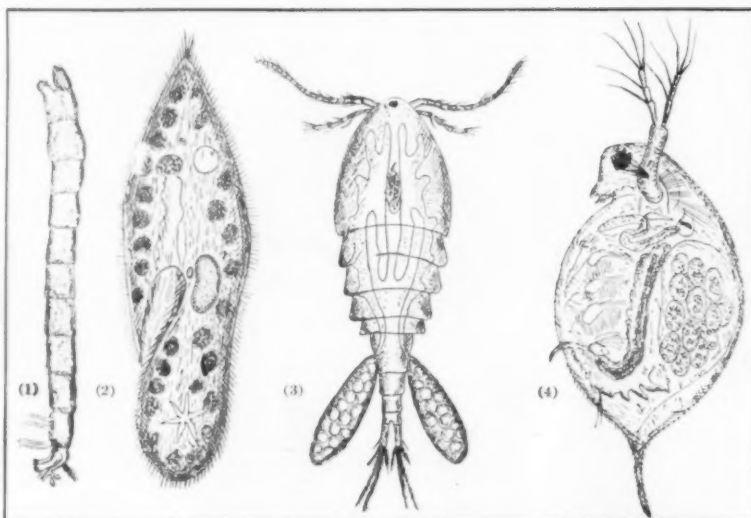
Current Methods of Disposing of Organic and Mill Wastes, and Their Bearing on the Food Question

By P. W. Claassen

**FOUR-FIFTHS** of the earth's surface is covered with water and one-fifth constitutes wet or dry land. It is safe to say that less than one-half of all the land is being utilized in the production of food and other necessities of life, so that we are dependent, largely, for our sustenance upon the products derived from one-tenth of the earth's surface.

Our cities are becoming more and more densely populated and the question of providing this great number of human beings with the necessities of life becomes greater each day. Agriculture has advanced so rapidly that today we are literally raising two potatoes where one grew before, and due to the study of animal industry our cows are yielding two quarts of milk where they yielded one before. But whereas we have doubled and trebled the products of the land we have done nothing to improve the culture of water life. We have given all our attention to agriculture and not only neglected and ignored aquaculture but we have grossly abused the fresh waters from which a great part of our sustenance should be derived.

We all like the water as a recreational center and fishing is one of our chief sports during the summer; but it seems that we imagined that the fish "just grew" in the streams regardless of how the waters were being abused. Most of us, however, have discovered that the fishing in many of the streams is not as good as it used to be. People have concluded that such streams have been "fished out" and have not given the question much further thought. What then are the reasons that so many of our favorite fishing grounds have lost their attractiveness to the fisherman? Is it because the fish have all been taken out and the streams thus made barren? This is so only in part. The principal reason why our fresh waters are so bare of fish life is because we have looked upon our streams, not as a source of food supply, but as the public sewers which Nature has provided for man's convenience. The best site for a town is that near a stream, and a city must be built on a large river or lake. The purpose of the river is to furnish water to the city and to carry off the sewage. Such an arrangement seems practical and saves installing costly plants for the disposition of the sewage; it was only when our cities became so numerous that a number of them sprang up



1. Bloodworm. 2. Paramecium. These creatures,  $\frac{3}{4}$  and  $\frac{1}{50}$  inch long respectively, thrive in water polluted by organic wastes. The bloodworm forms excellent fish food, and through it waste may be made ultimately beneficial to fish life. 3. Cyclops. 4. Daphnia. These measure less than  $\frac{1}{10}$  inch in length; 100 to 200 of them make a good meal for a fish, but they occur only in fresh water and pure water.

Four of the small creatures on which food fish thrive, and their relations to water pollution

along the same river that the question of sewage disposal plants arose. There are, however, even today, many cities which still discharge their sewage directly

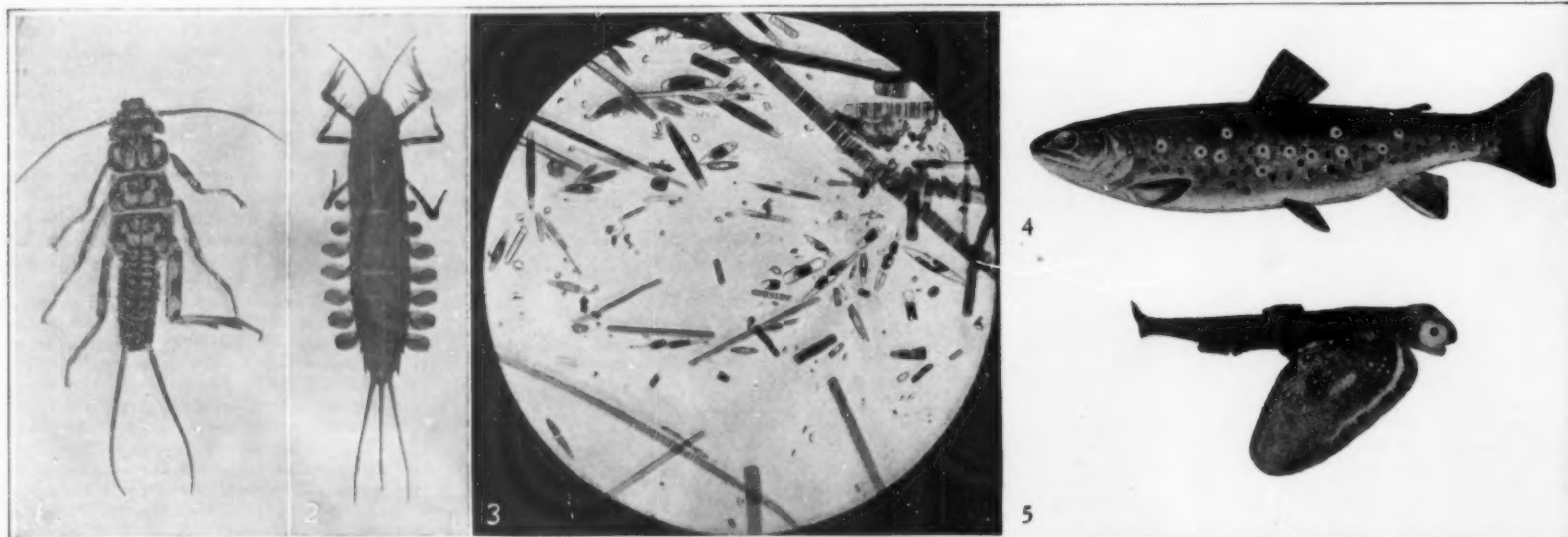
"bite" when the stream seemed perfectly clear and normal. A small amount of sulfuric acid or sodium cyanide discharged into a stream, accidentally or otherwise, may not alter the general appearance of the water and yet it may kill every fish, insect and plant in the entire stream. Once a stream has been depleted of its plants and animals it takes months and even years to bring it back to normal again even though no further pollutions occur.

One can hardly point out a stream in the Eastern States which does not have from one to a dozen or more factories or industrial plants situated on its banks. The wastes produced are of various kinds: acids, salts, lime, sawdust, waste from tanneries, paper mills, acid and alcohol factories, dairy plants and others. Most of these wastes, whether organic or inorganic, are detrimental to all the living organisms which normally occur in fresh water, annually killing millions of fishes both large and small. Not only are the fishes killed, but also the

**WITH** the increase of urban population and the changes, still too embryonic in character to be clearly defined, which are coming over our agriculture, the problem of food production is an ever-pressing one. What means shall we adopt to insure that enough food for all may still be supplied by the ever-decreasing proportion of our population that devotes itself to this business? Dr. Claassen points out that eighty per cent of the world's surface is covered by water, and that if we would only treat it right, this water would be the source of supply of a collection of food products that stand high in the scale of economy, by virtue of the minimum amount of labor required to make them available.—THE EDITOR.

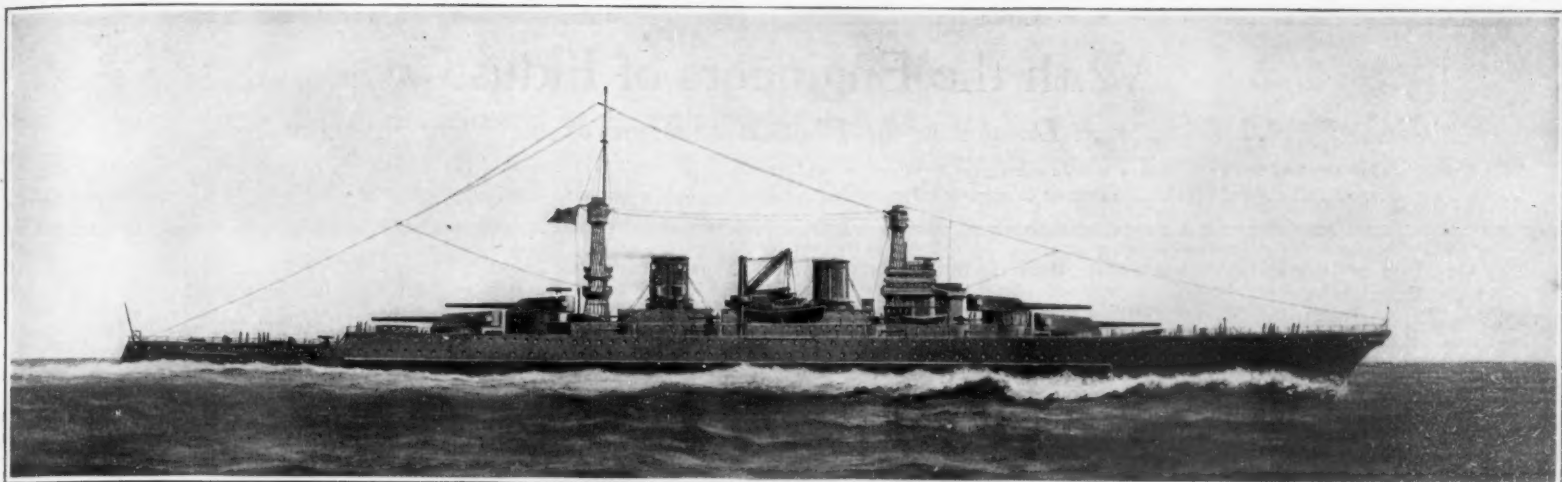
into the streams. Troy, for example, discharges its domestic sewage untreated into the Hudson, and Albany, a few miles below, takes the water and dis-

poses it into the Hudson. Troy, for example, discharges its domestic sewage untreated into the Hudson, and Albany, a few miles below, takes the water and dis-



1. A stonefly. 2. A Mayfly. These insects, which constitute the food of trout and other fish, are very sensitive to contaminated water and are quickly killed by it. 3. Drop of water highly magnified to show the microscopic plants on which such creatures as stonefly and Mayfly in turn feed. 4. Brook trout, a game fish which must have clean water; it cannot live in contaminated streams. 5. Baby trout, at a stage when it is very frail, and liable to be killed by a minute quantity of poisonous material

Three stages of fresh-water life, each of which furnishes food for the higher form, and the last for man; all are highly sensitive to contaminated waters



Length: 874 ft. Beam: 105½ ft. Displacement: 43,500 tons. Officers and Men: 1,500. Horsepower: 180,000. Speed: 33¼ knots. Battery: Eight 16-in., 50-cal., sixteen 6-in., 53-cal., four 3-in. anti-aircraft, four submerged and four above-water 21-in. torpedo tubes. Armor: Outer belt and inclined interior—thickness not made public

#### United States Battle-Cruiser "Constellation"—class of six ships

### Most Powerful Coast Defense Gun Yet Built

THE largest and most powerful coast defense gun in the world has just been completed at a United States Government Arsenal near Boston, Mass. This weapon is a 16-inch high-power gun mounted on a Disappearing Carriage, especially designed for seacoast defense purposes. The gun weighs 170 tons, while the carriage upon which it is mounted weighs an additional 670 tons. The picture shows this enormous weapon and its carriage. When emplaced in the seacoast fortification, the gun and carriage will be behind an embankment of sand and concrete of such great thickness that the highest power naval guns will not be able to penetrate it. This embankment will reach nearly to the height of the gun, so that when the latter is fired only the muzzle can be seen. When fired, the shock of discharge, acting along the axis of the bore, drives the gun into the loading position which is 12 feet below the position of the gun shown in the photograph. A slit which is clearly shown in the photograph, is provided in the armor to allow the gun to recoil back and down to this lower position.

The great energy of recoil is absorbed in a number of different ways. Some of it is absorbed in forcing the gun down into its loading position, which raises a huge counterweight weighing 313 tons, 9¼ feet. This counterweight is also used to raise the gun back into its original firing position above the parapet. The remainder of the energy of recoil is absorbed in large hydraulic cylinders located on the carriage. The carriage is also provided with a number of hydraulic dash pot systems, so that in going from one position to another, the energy is gradually absorbed in such a way that there is no shock to the carriage.

For sighting, the carriage is provided with a periscopic sight, similar to that used for submarines, which may be seen in the picture projecting through the armor. This sight allows the gunner to lay the piece upon the hostile vessel without exposing himself above the parapet. Although the gun and carriage weigh 840 tons, they can be easily turned in direction by the power exerted by one man applied at the traversing hand wheel. In other words, the gunner looking through the sight can, by turning a small hand wheel, move the gun and carriage in direction and accurately place it upon the target. The carriage is also provided with electric motors and hydraulic speed gears, which allow the gun to be turned in direction by power under the control of the gun pointer.

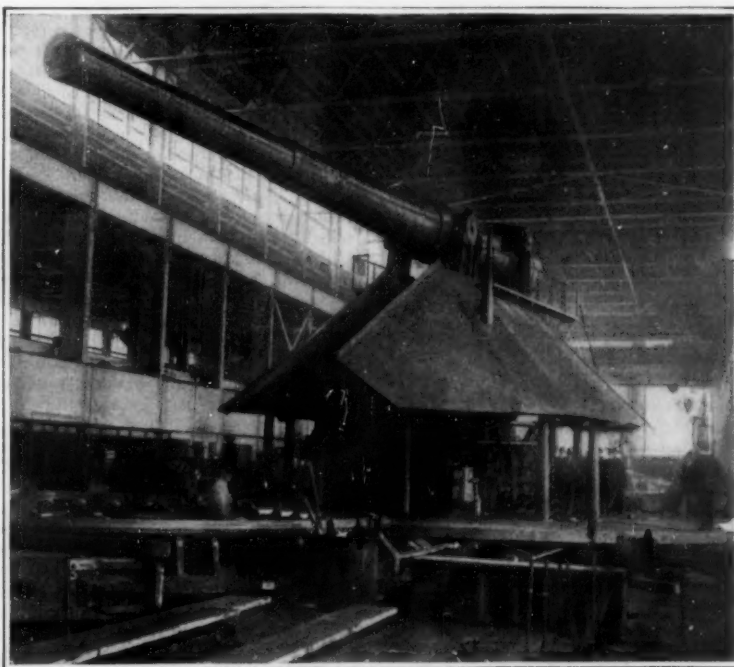
One other interesting feature about this type of carriage is the fact that the elevation of the piece can be accurately laid off while the gun is in the recoiled position behind and below the parapet. The rate of fire of this enormous piece of ordnance will be a little better than one shot per minute. The heaviest armor-piercing projectile used with this gun weighs 2,400 pounds and gives a range of over twenty-two miles. The powder charge for the gun consists of 850 pounds of smokeless powder. The projectile has

sufficient power to penetrate any armor which can be placed upon the largest naval vessels and at any range. One direct hit with this piece of ordnance would probably disable and might completely wreck a dreadnaught.

The light armor plate shown in the picture protects the gun crew from small shell fragments, stones and debris which might fall about the gun if enemy shells should strike the parapet. The armor is also of sufficient thickness to protect the crew operating the piece from machine guns mounted in airplanes. A crew of about 125 men are required to operate, load and fire the piece.

### New Road Projected in Ecuador

IT is intended to construct a road in Ecuador from the port of Emeralds in the direction of Quito to connect with a road already constructed from that city to the town of Santo Domingo de los Colorados, making the shortest route of communication between Quito and the coast. The principal object of the road is to make accessible about 1,000,000 acres of fertile lands covered with virgin forests, generally level, and situated about 2,000 feet above sea level, thus having a good climate. The concession of the lands is very liberal and secures to the constructors of the road the right to something like 500,000 acres of the lands. The toll concession is also liberal, and the waterpower sites add to the value of the scheme. By reason of shortness the route will dominate passenger and freight traffic into and out of the interior, and will doubtless attract tourists.



New 16-inch, 170-ton, Disappearing Coast Defense gun. Shell 2,400 pounds. Powder charge 850 pounds. Muzzle velocity 2,700 f.s. Muzzle energy 121,430 foot-pounds

#### The most powerful coast defense gun yet built

### New Battle-Cruiser "Constellation"

By J. Bernard Walker

THE wash drawing of the new United States battle-cruiser "Constellation" which we present has been prepared from an official sketch received from the Navy Department. It will be agreed that this great ship, when it is completed, will be as handsome as any naval vessel afloat. It is some five years since the design for the ships of this class was first made public, and it must be admitted that improvements which have been made during that interval have resulted in the ship's having a contour and general relationship and proportion of parts which leaves nothing to be desired. The substitution of two big funnels for the original five funnels and the spacing of these funnels and the masts is very pleasing. Also, the placing of the four turrets well in from the stem and stern of the ship is conducive to good appearance, and will be favorable to an easy motion of these ships in a seaway.

Speaking generally, "Constellation" carries our minds back to the battlecruiser "Hood," although the characteristic clipper bow and the cage masts will make a sufficient difference in the silhouette to readily differentiate the one from the other. The "Constellation" is a larger ship by some 2,000 tons. She is 14 feet longer and has about a foot and a half more beam. Her speed is greater by about a knot and a half, and in her main battery she carries the 16-inch gun, as against the "Hood's" 15-inch.

The principal dimensions of the "Constellation" are as follows: length between perpendiculars, 850 feet;

length overall, 874 feet; beam on load water line, 101 feet 8 inches; extreme breadth, 105 feet 5 inches; mean draft, 31 feet; and normal displacement, 43,500 tons. The armament consists of eight 16-inch, 50-caliber guns carried in four 2-gun turrets, and sixteen 6-inch, 53-caliber guns mounted in casemates on the spar deck and in the open on the boat deck. There are also four 3-inch, 50-caliber anti-aircraft and four 6-pounder saluting guns. The torpedo armament is heavy, consisting of four submerged and four above water 21-inch torpedo tubes.

As originally designed, on a displacement of 35,000 tons, these ships were to develop 35 knots, with 180,000 horsepower. Steam was to have been supplied by 24 water tube boilers; but so great were the demands for space for the combined steam and electric machinery, that only twelve of the boilers could be accommodated below the protective deck, and the other twelve were placed on the deck above. To have placed all the boilers below deck would have brought the outer boilers too near to the skin plating of the ship, and would have exposed them to destruction and flooding by torpedo attack. Opinion both inside and outside of the Navy was against the perilous practice of placing boilers above the protective deck, and in the ships as redesigned, the beam has been increased from 90 to 105½ feet, the number of boilers has been

(Continued on page 100)

# With the Engineers of Industry

## A Department Devoted to the Physical Problems of the Plant Executive

*This department is devoted to business men, works managers, production engineers, and all other executives seeking the maximum efficiency in carrying on their work. The editor of this department will endeavor to answer all questions relating to plant equipment, factory management, and industrial affairs in general.*

### The Question of Industrial Housing

THE most general application of the industrial housing principle has been worked out in the cotton mill villages of the Southern States. In the beginning, these villages were established through sheer necessity of finding some place for the mill workers to live. Little attention was paid to architecture, surroundings or sanitation. The houses were usually plain and the villages themselves were lacking in attractiveness.

So much for the past. But a great change has come about in the last generation. It has been generally realized by employers that, other things being equal, the better the village the better would be the class of workers. Desirable homes mean less floating of population and less of costly labor turnover.

Industrial housing problems develop along two main lines, namely, making over existing buildings, and putting up new buildings. In most instances the problem is a combination of both. The village of Winnsboro, S. C., in which the workers of the Winnsboro Mills are housed, is an example of recent construction. The village itself is situated on high land, in a healthful location and with excellent drainage. The houses are of substantial frame construction, with five or six rooms, all on one floor. Each house has excellent plumbing, toilet facilities, and heating arrangements. A supply of good water is provided. Pasturage for cows is available.

Other features of this village are an attractive school, a dispensary with operating room and a nurses' house where children may be left in the care of a trained nurse while their parents are working. Winnsboro is a new village, built from the ground up, so to speak.

Then there is Hogansville, Ga., which is a case of making over an existing village, where the Hogansville Mills of the International Cotton Mills are located. This was an ordinary mill village with rather more than its share of dirt and discontent. The industrial housing engineers in charge of this work began by painting. Then they fixed up the standing houses in good shape and built many new ones. Plenty of room was left for gardens and lawns. Trees and shrubbery were planted, streets were graded, sidewalks laid, water and sewer systems installed, and all wires were placed underground. Extensive playgrounds were made, with a swimming pool, over which is now being constructed a community house with auditorium, social and class rooms, bowling alley and other features. Today Hogansville is a joy to the eye. Better still, workers like to live there and they take pride in their homes and their town. It is a real community.

The largest housing operations ever undertaken in this country were in connection with war industries of various kinds. A majority were of temporary construction, but a number of permanent towns and villages were built with almost the speed of temporary work.

Space only permits the mention of a typical wartime undertaking. The Yorkship Village, which is probably the largest permanent housing operation constructed in the United States and is in many respects the most notable, is our

example. When the Government's great program of shipbuilding was begun early in 1918, the facilities of the New York Shipbuilding Company were greatly increased and thousands of employees were added. To house these employees Yorkship Village was planned. It is located near the company's yards, on the outskirts of Camden, N. J.

Ground was first broken on the site of Yorkship Village on May 20, 1918. Before March 1 of the following year, 907 houses were ready for occupancy. Another three months saw 1,386 houses, a hotel and 56 apartments completed. Streets have been paved, sidewalks laid, lawns graded and trees have been planted. Yorkship today is an attractive, complete village, equipped to house approximately 10,000 persons.

The problem of housing the workers is a big one—and one that requires the attention of industrial housing specialists. Fortunately, there are engineers who specialize in just such problems, and who are always ready to plan and execute plans for housing anywhere from a dozen to ten thousand workers and their families.

### The Role of the Portable Belt Conveyor

THE handling of materials in quantities for comparatively short distances cannot longer be undertaken by outworn wheelbarrow methods. Even ignoring the cost of these methods, the present labor shortage makes such an extravagance of human effort practically impossible. Although portable conveyors have been used for handling bulk materials under various conditions for many years, such machines have been heavy, crude affairs. In fact, heretofore no serious study has been given to the proper design and manufacture of these conveyors, or to the development of their logical markets.

But the time has come when the portable belt conveyor is really practical and even necessary. Almost daily new uses for these conveyors are being developed. It is simply a new tool offered the industrial world, and the latter is only beginning to learn how to use it. Among the numerous applications which have recently been found for the portable belt conveyor are:

1. Unloading cars. This is the most general use and probably the most important. It applies to box cars, dump cars, gondolas; in some cases with shoveling and sometimes with most of the shoveling eliminated.
2. Loading cars from stock piles, factories, pits, warehouses and so on.
3. Piling coal, especially in making emergency storage piles. It can also be used for moving coal about in large storage piles so as to prevent deterioration.
4. Reclaiming from storage in manufacturing plants, delivering to fixed conveyors or other machines.
5. Piling bags and boxes in warehouses.
6. Removing overburden from pits or quarries, delivering material back into the pit.
7. Fueling steamers from barges or docks.
8. Loading wagons and trucks from piles or bins.
9. Feeding stoker magazines from bins.
10. Handling excavations from basements.

In general, the portable belt conveyor can handle all materials in bulk or package. These conveyors are handling

coal in all sizes from slack to large lumps, as well as other materials of the same physical characteristics and in the same range of sizes. As for operating costs, these are not of great consequence. One or two kilowatts of electrical energy, costing 2 to 10 cents per hour, drives a short conveyor, and three to five kilowatts, a long conveyor. Belts wear from one to three years according to service.

### Electric Cranes in the Leather Industry

THE cost of handling hides in the beam house and tan yard became too large an item in the production cost of a Newark, N. J., leather company, so the use of an overhead electric crane for the purpose was given thorough consideration. As a result, a 2½-ton leather-handling crane was installed, and it has been operating for close on to three years with excellent results.

The frames carry from 50 to 60 hides each; as a result, the output of the plant has increased from 300 hides daily to 500 hides daily. Previous to the installation of the crane, 40 to 45 men were employed in the beam house and tan yard; but now 12 men are putting through 50 per cent more hides than the 40-odd men were capable of doing. Based on a reduction in the working force of 30 men at \$25 a week each, minimum wage, a saving of well over \$30,000 per year in labor cost is realized, which is equivalent to the interest on \$500,000 at 6 per cent.

These many advantages, which are being brought to the attention of the leather industry, are bound to cause the widespread utilization of electric cranes in the not distant future.

### How Much Electric Current for Heating?

LARGE industrial plants and factories find electric air heaters useful in heating crane cabs, outhouses, valve, pump and meter houses, exposed remote corners or rooms, watch or signal towers, for shearmen and tablemen in steel plants, in theater ticket booths, as well as for scores of miscellaneous applications. Flexible electric conductors will carry electric heat cheaply and efficiently to the most inaccessible points.

As a rule, best results will be obtained by installing several small electric heaters, as they are easy to handle and can be arranged in various combinations to suit the space available, while temperature regulation is readily obtained by a simple arrangement of knife switches permitting any number of units to be cut in or out of circuit.

Anyone may readily figure the amount of electric current necessary for heating a given space. Here are the thumb rules:

A.—35 watt per cubic foot. This takes care of the heat required for raising the temperature of the air approximately one complete change of air per hour. For more frequent changes, increase the wattage proportionately.

B.—Plus 3.5 watts per square foot of wall area. This takes care of the loss of heat through the walls. In figuring the wall area, the area of the four sides of the rooms and the ceiling and the floor are all included and a deduction is made for the glass area. This rule assumes good building construction, such

as a good 12-inch brick wall or a well-made double frame wall.

C.—Plus 35 watts per square foot of glass area. For measuring glass area, the overall area of the frame is measured and this area is deducted from the total wall area.

The foregoing procedure assumes a temperature elevation of 70 degrees, or, in other words, external temperature of zero, room temperature of 70 degrees. If the room adjoins other heated rooms, allowance must be made, based on the difference in temperature between the room under consideration and the adjoining room.

Where a satisfactory steam or hot water system is in use, or where the architect has calculated the steam or hot water requirements, these can be translated into electrical capacity very simply.

One square foot of radiating surface using low pressure steam is equivalent to 70 watts. One square foot of radiating surface using hot water is equivalent to 44 watts. Therefore, if a heating system is in satisfactory use with a radiating surface of 100 square feet, it would require a heater of 100 x 70 or 7,000 watts capacity, if steam, and 100 x 44 or 4,400 watts if hot water.

It should be noted that the thumb rules given determine the heater capacity or watt rating required, which is quite a different thing from determining the average amount of heat or current required, or the total consumption during the heating season, as the heater would not be expected to operate at full capacity all the time, but would operate most of the time at a reduced capacity and cut off part of the time.

### Speaking of Reclamation

RECLAIMING and utilizing scrap material has been impressed on the railways by war conditions, and at the recent annual meeting of the American Railway Engineering Association it was shown that many railways have erected special reclamation shops.

A reclamation plant established by the Rock Island Lines at Silvas, Ill., has a scrap dock 48 ft. wide and 1,500 ft. long, with six bins 28 x 42 ft. for storing unsorted scrap, eight bins, 28 x 30 ft., for sorting scrap, and 74 bins of various sizes for sorted scrap. Three traveling gantry cranes of 4 and 10 tons capacity have lifting magnets for 1,500 and 8,500 lb. loads. A shop 25 x 270 ft. contains a 100-lb. hammer, two 150-lb. power hammers, double and single alligator shears, bolt shear, rattler for cleaning, drill press, nut tapping machine, four electric welders, four oxygen welding outfits, air-operated shear, and air-operated punch.

This plant is doing such work as welding cast-iron spokes on driving wheels, building up worn spots on fire-box castings with acetylene welding; mating and repairing flange-worn steel-tired wheels before turning, thereby saving a great deal of labor; reclaiming salt deposits from refrigerator cars for use in thawing switches during the winter, and for use in fire barrels; pressing oil from waste (one barrel of waste netting about 20 gal. of oil); burning the waste and reclaiming about 50 lb. of habbitt, reclaiming barbed wire for use in building rip-rap.



Copyright, Keystone View Co.

A foundation as tall as the house itself has made this apartment house possible

### An Apartment House Built on Stilts To Fit Its Site

WHILE there is nothing new in building a house on the slope of a steep hill, it is equally true that the apartment house shown in the accompanying view is an exceptionally daring case of building on a steep slope.

A New York property owner had a parcel of land facing the Hudson River. This parcel of land, following the regrading of the street, lay 30 feet below the street level at the front or street end and some 120 feet below the street level at the extreme rear. No better site could be found for an apartment house, because of the splendid and unobstructed view of the river. So the parcel of land was utilized for a lofty apartment house, by means of a huge foundation which is higher than the house itself. The backyard of the apartment house, which is a double house, by the way, is supported by tall steel pillars, as shown.

### Another Try at the Safety Poison Bottle

WITH the death-toll due to accidental poisoning always before us, it is little wonder that so many attempts are constantly being made with a view to making poison bottles as safe as possible. Some of these attempts are extremely ingenious, and the range is all the way from bottles with the prickly sides of the porcupine, to bottles with radium labels.

At the recent Chemists' Exhibition held in London there were exhibited a number of novel bottles for the prevention of accidental poisoning. Several of these are shown in the accompanying illustration. One of the bottles, it will be noted, is so made that it will not stand in an upright position, therefore it is almost impossible to mistake it for another bottle in the dark. Two of the bottles—the tall ones on either side of the picture—are provided with a lock and key arrangement for the stopper. The fourth bottle has a cup-shaped top which precludes mistaking it for a conventional bottle.

### Speeding Up the Perforating of Grease Cellar Plates

AN interesting method of perforating the plates used in connection with grease cellars in locomotive driving boxes is being employed by the Norfolk and Western Railway at their shops in Roanoke, Virginia. The largest plates are 18 inches wide and the standard lengths are 8 feet.

The sheets of metal are placed on a guideway and entered between the feed rolls to which is attached an arm with an adjustable rod. This rod controls the movement of the sheet into the punch at the opening stroke. The punch consists of four rows of punches. Thirty-two punches in each row punch 128 holes 3/16 inch in diameter with every stroke of the machine. In order to break the load the punches are varied in length.

The punch die consists of a solid steel plate with holes drilled and reamed to suit. The punch, in reality, is automatic as all that is necessary is to start the sheet between the rolls. One man handles the work and about eight plates may be entirely punched in an hour. The cost of punching each plate is claimed to be nine cents.

### Tagging the Elusive Finger-Print

WHAT has been described as the greatest step forward in the science of criminal identification in recent years is the new process discovered by Detective Sergeant Fred. G. Sandberg of the Washington Police Force. This process makes it possible to make finger prints from transparent objects without the use of a camera and lens. It consists of covering the finger prints with aluminum powder and then making a direct contact print on to a piece of sensitized film or photographic paper. This method has been adopted by the International Association for Identification, which numbers among its members some of the foremost finger-print experts in the world.

### Machine for Testing Shrinkage in Fabrics

CONSUL WALLACE J. YOUNG, of Bradford, England, has transmitted clippings from current English periodicals setting forth the result of recent investigations in testing shrinkage in cloths by a mechanical device lately perfected. The substance of these reports is as follows:

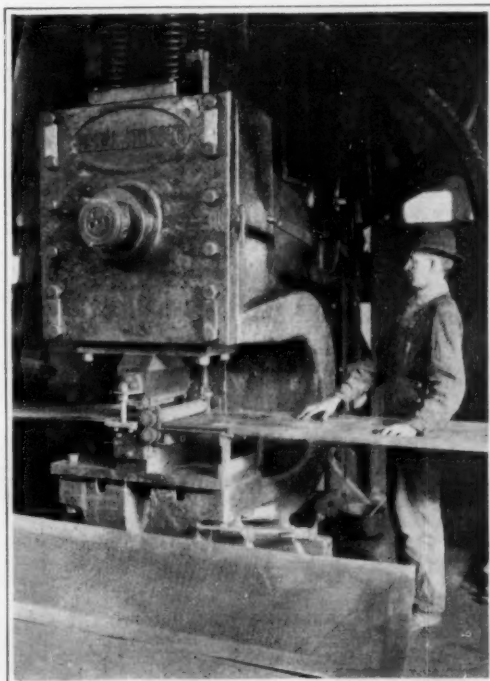
The amount of shrinkage which a cloth has undergone in the process of finishing has about it an element of guesswork; even the expert analyst has had to bring to bear on his work knowledge gained by past experience. Comparing the texture under analysis with textures similar in type, he has frequently drawn conclusions which, when put to a practical test, have proved faulty.

In cloths where slight shrinkages take place the matter is not so serious as when the shrinkage reaches as much as 40 per cent, but even with cloths low in shrinkage estimation of finished results are often unsatisfactory.

Let it be supposed that an estimated shrinkage is 10 per cent, the actual being 12 per cent. To give a finished width of 56 inches, the loom widths would be,



Four novel poison bottles exhibited in London before the leading chemists



The rollers handle the sheet through the punch press, reducing cost and time



Applying aluminum powder on finger prints on a glass plate to bring them out

for 10 per cent,  $56 \div 0.90 = 62.2$  inches; for 12 per cent,  $56 \div 0.88 = 63.6$  inches.

If the cloth is set 62.2 inches, the finished width after 12 per cent shrinkage will be therefore 0.88 of 62.2 inches, or 54.7 inches, in place of the desired 56 inches.

Anyone acquainted with the trade knows that a serious loss to the maker would result, as the goods would either be rejected or a claim would be made—the goods supplied being under the specified width. If, then, an error of 2 per cent is serious, it is manifest that the determination of the percentage loss due to shrinkage is of vital importance.

The usual method adopted for ascertaining the shrinkage of a fabric is as follows: A known width and length of the fabric is cut, say, 2 inches square, and threads are extracted reaching from side to side or end to end.

The appearance of these threads will be curved or waved. It is supposed that the difference between the size of the cloth (2 inches) and the length of the thread extracted, with the curvature removed, by hand, is the shrinkage. If the length of the thread is  $2\frac{1}{2}$  inches, the percentage of shrinkage is  $(\frac{1}{2} \div 2\frac{1}{2}) \times 100 = 20$  per cent.

To be absolutely sure of the length of the thread it is necessary to know the tension which must be applied in order to bring the thread back to its original loom state. The only way to acquire dexterity in this work is to practice with cloths of known shrinkage until the touch is trained to the point of giving just sufficient tension to show the known shrinkage. It is quite reasonable to believe that it is possible to produce workers who can with fair accuracy tell the shrinkage of cloth when it does not exceed 20 per cent.

In the case of heavily milled fabrics, the tension which would be brought to bear on cloths having only a scoured finish is not great enough to elongate the thread sufficiently. It is therefore necessary to practice with milled cloths until a fairly reliable degree of accuracy is attained.

The first difficulty experienced by the beginner in this work is the removal of threads sufficient in number to make an average test. As a rule, a cloth with a shrinkage of 35 to 40 per cent placed in the hands of a student is returned with the remark that it is impossible to remove intact a sufficient number of threads to make a test. If, however, the cloth is torn, the thread on each side of the tear is quite easily removed, so that it is only necessary to make a sufficient number of tears to obtain a fair average of threads. The threads, when removed, should be placed between sheets of blotting paper, well saturated with water, and allowed to remain for 10 to 15 minutes. When removed it will be found that the tension required for stretching will be equivalent to that for scoured cloths.

From experiments made by students, this method has been found to yield admirable results, so that one feels justified in saying that the determination of shrinkage is no longer the vested interest of the man with years of experience.

The trade should welcome any means insuring greater accuracy, especially if much practice is not required, and will be interested to learn that a machine has been designed by Professor Barker, of Leeds University, for the purpose of ascertaining the contraction of a cloth due to shrinkage.

## Inventions New and Interesting

*A Department Devoted to Pioneer Work in the Arts*



The cylinder gage that can't go wrong

### A Novel Direct-Reading Automobile Cylinder Gage

BY using a device recently brought out by an Iowa manufacturer it is possible to measure accurately and simply the true size of automobile cylinders. The device is made of polished steel one-half inch wide and assembled in sets for various makes of cars. In use it is inserted into the cylinder, with the proper blade opened. The ends of the blades are true arcs and the measurement is from diametrically opposite points anywhere on the half-inch blade. The measurement, it is claimed, will be found correct even though the gage should not be held exactly at right angles to the wall of the cylinder being tested.

### To Catch That Drip

THE good housewife who finds that prohibition has failed to lighten her load to the extent which she had anticipated, and that where formerly the "gang" used to leave her tablecloth spotted with real stuff the only difference today is that the debris consists merely of grape juice, will doubtless welcome the French invention which we picture herewith. A brief examina-



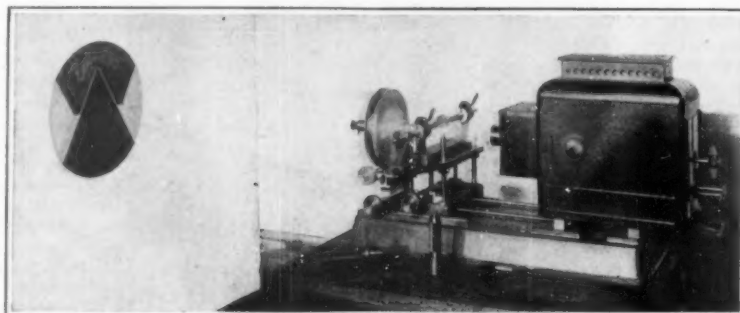
The metal standard catches the drop that rolls down the side of the bottle

tion of the picture will convince one that as the vagrant drops of the liquid run down the sides of the bottle, instead of reaching the cloth they are caught up on the projecting points of the little standard in which the bottle sets, and conveyed to the space between bottle and metal. The enterprising photographer suggests that this little contraption would be of value in connection with catsup and maple syrup, but we prefer to think of it getting as much joy out of life as is possible in connection with the present-day approved form of Navy cocktails.

### New Lantern for Screw Testing

A NEW design of projection lantern, which eliminates the right angle prism and the mirror, has been built recently by the National Bureau of Standards for use in the inspection of screw threads. The outfit formerly in service, taking its pattern from a type designed by the National Physical Laboratory of England, was expensive in construction and difficult of adjustment in factories where vibrations are excessive.

The newly-built apparatus incorporates the protractor for measuring the thread angle of screws as a component



Projection lantern that measures screw-threads in novel fashion

part of the lantern. The image is flashed horizontally and the lens system is such that with three different objects having focal lengths of 48, 32 and 16 millimeters, magnifications of 50, 100, and 250 are obtained at a screen distance of 5 feet. Rapidity and accuracy are insured, as well as a bright illumination and sharply-defined image for facilitating the view of the operator.

The lantern is likewise adaptable to the measurement of the pitch of thread plug gages and other threaded mechanism. When determining the pitch, precision gage blocks are used in conjunction with the micrometer. A setting is made with the image of one edge of the standard angle in coincidence with one side of the thread; a gage block equal in thickness to an integral number of threads is inserted between the micrometer spindle and the ball-end of the center on which the work is held; and thereby the work is displaced laterally at right angles to the axis of the lens system by an amount equal to the thickness of the block. Correctness of the test specimens is vouchsafed if the edge of the standard angle is again just in contact with the side of the thread. Otherwise, the amount necessary to bring the micrometer into coincidence reveals the existing error in the sample of lead.

Six of these lanterns have been built for the Ordnance Department of the United States Army, and it is antici-

pated that the apparatus can be applied in the measurement of profiles and templates. In actual use, a block is inserted between the micrometer and the center before the initial setting as well as at the second setting.

### Truck Equipment for Orchard Spraying

A SPECIAL orchard sprayer, designed and built for use on a standard 2½-ton chassis, is stated to be an exclusive product and the only equipment of its kind on the market at the present time. Its perfection is the result of long and studied experiments made with a view to offering to orchard owners a practical and efficient tree sprayer. In a practical trial recently conducted in an orchard, a solution of lime and sulfur was used. With a man driving the motor truck and two others using spray guns, the small trees in this orchard were sprayed at the rate of about 150 per hour. During the test the sprayer outfit proved clearly its ability to do its intended work quickly and efficiently, and foreshadowed a remarkable improvement in orchard spraying.

The tank has a capacity of 6,000 gallons. The pump is of the rotary type, driven from the power take-off attached



A twist of the knurled thumb-nut squeezes out the tooth paste

### Squeezing Out the Last Bit

FRENCH economy and ingenuity are very much in evidence in the tooth-paste dispenser depicted in the accompanying illustration. Here is a little device intended to take a standard tube of tooth-paste and to squeeze the tube by the manipulation of a knurled thumb-nut. In this manner, the tube is mounted on a wall, out of the way of dust and dirt; and what is more, the squeezing process starts at one end and is pursued evenly and smoothly until the entire contents have been squeezed out. This is in marked contrast to the usual method which gets the tube all out of shape and wastes a good deal of the contents. The details of the device are self-evident in the illustration.

### Rowing in the Opposite Direction

THE rowing device shown in the accompanying view makes the rowboat go in the opposite direction to that with ordinary oar locks. That is to say, when the oar handles are pulled toward the rower, the oars are moved backward through the water instead of forward. This causes the boat to move forward or in the same direction as the rower is sitting.



Simple arrangement of oars which makes a rowboat go in the same direction as the rower is facing

to the transmission. The capacity of the pump is 30 gallons per minute against 300 pounds' pressure. The excess capacity of the pump not used by the nozzles is pumped back into the tanks through jets located along its bottom, thereby providing perfect agitation of the spraying liquid.

The ability of this sprayer outfit to deliver two powerful sprays while being driven over the ground at low speed makes it a very fast working sprayer that will surely be a time and money saver to fruit growers. The spray pump operates either while the motor truck is in motion or standing still, and pressure can be maintained at the 300-pound mark without difficulty under all conditions. The spray thrown from the nozzles is exceptionally fine, which means economy in the consumption of spraying liquid. This is an important item and assures economy both in the amount of solution used as well as time consumed in spraying. Among the most prominent features of the sprayer may be mentioned that the tank is self-filling, self-agitating and self-cleaning. Of particular importance is the fact that the entire tank and all its attachments are easily removable. This feature enables the owner to use his chassis for general hauling when the sprayer is not in use. Fruit growers will readily see the advantages afforded by this feature as every advantage of a motor truck is retained.

## Prices—Today, Yesterday and Before the War

(Continued from page 81)

are well borne out by a glance over the list of peak dates. Rubber never during the war or after went any higher than the mark at which it sold in 1914; and it began to decline from that mark as early as February, 1919. Coal, on the other hand, is right now enjoying its peak—it has been going up uninterruptedly all the time. And the peaks in other commodities are fairly well distributed between February, 1919, and December, 1920; they do not by any means enable us to put our finger down at one point on the calendar and say, "Here is the great divide between rising and falling prices."

Our drawings, we think, show the situation up with sufficient clarity to demand a minimum of textual comment and explanation. In each case the size of the object pictured is proportional, on the three-dimensional basis of bulk represented, to the amount of the given commodity which may be purchased with a given sum of money.

It will be noted that the commodities employed for this comparison fall into four rather well defined groups. First there are the items which have gone almost as far back as the consumer could hope for them to go—which is to say, they have to all intents and purposes returned to pre-war prices. Copper is actually a shade lower now than it was in the good old days of 1914—\$100 buys 15 pounds more, or roughly, two per cent, now than it did then. Hogs and hides are within ten per cent of being as cheap today as seven years ago, and cotton has made almost as much of a recession.

The second group represents the bulk of our raw materials, which have gone down materially in price as compared with the peaks, but which still are materially higher than they were at the beginning of the war-time movement. Corn is the least offender; we get just seven-eighths as much of it for our money as in 1914. Of sugar we get 70 per cent as much and of wheat 60 per cent. Of silk we get 59 per cent as much and of wool 50 per cent. Of steel we get something like 45 per cent as much.

The third group is made up of the coals, anthracite and bituminous, which cost more today than ever before, in the case of the former, and far more than before the war in the case of the latter. Since 1914 anthracite has doubled and bituminous has tripled in price. Finally, in a class all by itself, we find rubber—which costs less today than it ever cost.

A little attention to the height of the various peak prices will be of interest. The highest quotation for bituminous coal was roughly nine times what it cost in 1914. The price of sugar was multiplied by  $6\frac{1}{2}$  between 1914 and the date of its peak; that of silk and of wool by  $4\frac{1}{2}$ ; of corn and of wheat by about  $3\frac{1}{2}$ ; of steel and of cotton by about  $3\frac{1}{4}$ ; of hides by 3; of hogs by somewhat more than  $2\frac{1}{2}$ ; of coal by 2; that of copper had increased by  $\frac{3}{5}$  before it turned again.

In any attempt to estimate just how far prices, as a whole, went before turning downward it is necessary to eliminate from consideration altogether the rubber market, which behaved in a fashion so entirely out of the general order of things. On the basis of the other twelve commodities considered, we may calculate that the average peak price brought about a condition under which \$100 would buy 32 per cent as much as it would in 1914. The general average for the downward trend since the peak shows that today \$100 would buy almost exactly two-thirds as much as in 1914, and therefore a trifle more than twice as much as at the peak of prices.

The greatest rise in price, as is pretty well known and as is indicated by the

(Continued on page 97)

# Use Lupton Service NOW

### Booklets on Lupton Service

We have published four booklets showing examples of Lupton Service applied respectively to: (1) machine shops; (2) foundries, forge shops and other heat-producing buildings; (3) general manufacturing buildings; (4) power houses. Copies will be sent free to any business executive, architect or engineer on request. State what types of building interest you.

## Lupton INVESTMENT VALUE STEEL SASH PRODUCTS

Lupton Pivoted Factory Sash—Cat. 10-LSS

Lupton Counter-balanced Sash—Cat. 10-LCB

Lupton Steel Partitions and Doors—Cat. LSP

Lupton Rolled Steel Skylight—Cat. 10-Misc.

Pond Continuous Sash for Pond Truss roofs, monitors, sawtooths and side walls—Cat. 10-PCS

Pond Operating Device for long lines of sash—Cat. 10-PCS

**B**UILDING is slack today; labor efficiency is increasing; transportation is better; materials are in good supply.

Business and financial conditions also will probably be right for building by Spring or Summer. Then the dam will break! Factory owners whose contracts have not been placed will find themselves bidding against all America for labor and materials.

Are your plans ready? Do they embody the latest advances in daylighting and natural ventilation, and in floor layout for efficient routing at minimum cost? Unless they do, your new factory will be a lost opportunity.

As makers of steel sash of unusual ventilating capabilities we have developed special applications of these sash to industrial buildings, by which results commonly thought impossible are secured. We do everything possible to extend this experience to our customers, advising them regarding not only the selection but the placing and operation of the sash, and even the most effective design of the building where that is involved.

The floor layout, the arrangement of roof planes, the inlet and outlet openings and manner of their control, the width and height of building, are all considered in relation to the manufacturing operations intended.

This consulting service is free to users of LUPTON STEEL SASH PRODUCTS. By availing yourself of it now, while the lull lasts, your architect and our engineers will have time to do your needs full justice. Send us your plans or sketches for preliminary suggestions. We may be able to add largely to the investment value of your buildings at no added cost.

No obligation, except your thoughtful consideration.

## DAVID LUPTON'S SONS COMPANY

Clearfield and Weikel Sts.

Philadelphia

Specialists in daylighting and natural-ventilation equipment for maximum production

\*Chicago      \*New York      \*Pittsburgh      \*Boston      \*Cleveland  
\*Detroit      \*Buffalo      \*Atlanta

Canadian Manufacturers: The A. B. Ormsky Co., Ltd., Toronto

\*Warehouses in these cities

View in main bay of machine shop looking toward front wall.

E. W. Bliss Co., Consolidated Press Branch, Hastings, Mich. Frank D. Chase, Inc., Ind. Eng'rs. Machine shop is behind office building, with storage building, foundry and pattern shop beyond. Pond Continuous Sash and other Lupton Products used throughout.



To-day—the Sash makes the Factory

## Recently Patented Inventions

Brief Descriptions of Recently Patented Mechanical and Electrical Devices, Tools, Farm Implements, Etc.

### Electrical Devices

**FUSE BOX.**—H. L. BULLOCK, Box 124, North White Plains, N. Y. The invention relates to magnetic blow-out fuse boxes using copper ribbon fuses, its object is to provide means whereby the operator is enabled to quickly and conveniently renew a blown-out fuse. Another object is to insure a positive contact between the ends of the ribbon fuse and the terminal blocks in the fuse box.

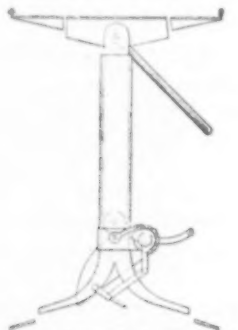
### Of Interest to Farmers

**PLANTER.**—H. JONES, Manchester, Ga. The object of the invention is to provide a device of the character specified adapted for planting hard grain, whatever the size, and for planting grain of several different sizes, at the same time, wherein the construction is simple, devoid of intricate parts and of easy adjustment.

### Of General Interest

**DOOR STOP.**—N. CRANK, Hill City, Kan. This invention relates to a door stop to be pivotally fastened on the floor to hold the door in open position. An object is to provide a combination door holder and stop capable of holding a door open in any desired position to prevent the premature opening or closing of the door. It is also a purpose to provide a door holder having the facility of being adjustable to accommodate doors of various thicknesses.

**ADJUSTABLE STAND.**—W. V. LEWIS, 38 N. College St., Schenectady, N. Y. Among the objects of the invention is to provide an adjustable stand which may serve as a drafting



A SIDE VIEW OF THE DEVICE

table, a reading table or for any similar purpose, and which may be readily adjusted to desired heights as well as to desired angles, and to provide means for clamping the top in its adjusted position.

**SEPARABLE FASTENER.**—E. R. NEBELING, 21 Maiden Lane, New York, N. Y. The invention pertains to a separable fastening of the head-and-socket type which may be applied to the strap of a wrist watch or similar article of jewelry. The primary object being to provide means by which the head may be positively locked in engagement with the socket. A further object is to provide means by which the sliding movement of the locking member is limited.

**DOLL HEAD.**—L. E. KAMPE, 271 S. Connecticut Ave., Atlantic City, N. J. A purpose of the invention is to provide means for manufacturing doll heads, and more particularly for manufacturing the faces thereof. An object is to provide doll faces with variable features in form and expression which either has a hard, unyielding surface or which has a yieldable soft, skin-like and pliant surface according to the desires of the manufacturer.

**DISPLAY CARTON.**—O. C. THUM, 15 E. 10th St., New York, N. Y. The primary object of this invention is to provide a carton in which the material or goods contained therein may be advantageously displayed for sale, the carton being capable of being closed to protect its contents when not in display position. It is a further object to so construct the device that all the printing may be done by a single operation.

**BOTTLE TOP AND LOCK.**—W. A. WHEELER, 998 5th Ave., New York, N. Y. An object of the invention is to provide a combined cover and lock for a bottle or similar receptacle which is in the nature of a combination lock whereby it cannot be removed until the combination has been properly actuated. Another object is to provide a closer wherein

the neck of the bottle is formed with a stepped construction and a corresponding shaped cap is provided with locking means for holding the cover in place.

**COMBINED SHAVING BRUSH AND SOAP HOLDER.**—J. MCGUIRE, 2477 Master St., Philadelphia, Pa. Among the objects of the invention is to provide a device especially useful to traveling men or any others whose packing facilities are limited. More especially the device embodies a shaving brush having telescopic handle and container for keeping the brush clean, and serving at the same time as a soap holder and ejector assuring that the soap may be used most conveniently and economically to the last particle.

**PROCESS OF CONSTRUCTING FABRIC STRUCTURES.**—C. A. SALISBURY, 61 Ann St., New York, N. Y. This invention relates to theatrical equipments, and it pertains more particularly to a mat or cloth covering for stage surfaces, commonly known in the art as ground cloth, stage cloth, etc. The primary object is to construct a device made from a plurality of individual strips of canvas sewed to form a single mat capable of withstanding excessive wear and the strain to which it is subjected.

**FASTENER MOUNTING.**—BERTHA CLARK, 342 50th St., Brooklyn, N. Y. The object of this invention is to provide a fastener mounting arranged to support fasteners of the stud and socket type in sets to permit a dressmaker to readily sew the fasteners in spaced relation to the article on which the fastener is to be used. Another object is to allow the user to readily separate the stud and socket members without the use and breaking of the finger nails.

**ICE SKATE.**—M. U. SMART, 97 Chester St., Allston, Mass. This invention relates more particularly to the foot support and engaging means of ice skate blades, the object being to do away with the use of threaded and other detachable parts, particularly those which may be unscrewed or otherwise detached and are thereby susceptible to misplacement. A further object is the provision of an arrangement capable of ready manufacture at small cost.

**HAT MIRROR.**—L. W. HOSFORD, 1184 Regent St., Alameda, Cal. The object of the invention is to provide a mirror convenient for use in emergencies, in the form of an attachment for hats or caps, the device including a flap carrying the mirror and an elongated flexible element on the flap adapted to be secured to a hat or cap for positioning the mirror at the sweatband adjacent to a brim or visor.

**CROCHET NEEDLE.**—C. E. ENSFIELD, Fennville, Mich. The invention has for its object to provide a needle wherein resilient holders are provided in connection with the handle, for engaging the ball and the thread, to prevent unwinding of the ball and to prevent unraveling of the work, and to hold the ball, holder and the needle together.

**DOOR CLOSING DEVICE.**—C. A. PURVIS, 1705 Jefferson St., Kansas City, Mo. The invention relates particularly to a spring device for closing doors and for maintaining the same in closed position, a purpose being the provision of a device of this character which is of simple and efficient construction and may be readily applied to doors of ordinary construction.

**SHAVING STICK HOLDER.**—R. SILLER, 1053 E. 10th St., Brooklyn, N. Y. This invention relates generally to a holder for soap, and is particularly adapted for use as a shaving stick holder, the construction being such as will permit a certain part of the shaving stick to extend beyond the holder, a suitable removable protecting holder being provided which in no way comes in contact with the stick, but at the same time serves to protect the unused portion.

**MANUFACTURE OF LITHOPONE.**—J. L. MITCHELL, c/o Natl. Lead Co., 111 Broadway, New York, N. Y. This invention relates to a process for manufacturing lithopone which consists of washing and drying a product formed of barium sulfate and zinc sulfide, then pulverizing this product, then subjecting it simultaneously to heat and agitation in a muffle furnace to calcine the product, then quenching it in cold water and finally drying it.

**ARTIFICIAL FISH BAIT.**—E. M. SMITH, 1020 N. 14th St., Birmingham, Ala. The object of this invention is to provide an artificial bait, designed particularly for trolling in

weedy waters, the bait being so constructed that the hooks are normally housed to be protected from engagement with weeds or other obstructions in the water, the device operating when the bait is swallowed by a fish to release the hooks and allow them to move into exposed position for hooking the fish.

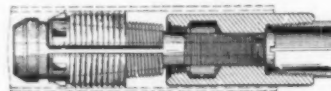
**WATCH CLASP.**—B. B. SCHMEING, 1008 York St., Quincy, Ill. This invention has for its object to provide a clasp of the character specified adapted for connection with the pendant of a watch of any type and having means for clamping the material of the pocket between the watch back and the clasp to prevent loss or theft of the watch from the pocket.

**FLY SWATER.**—B. R. JOLLY, 128 Fayetteville St., Raleigh, N. C. The object of the invention is to provide a trigger-controlled device consisting of two leaves mounted to swing toward and from each other to grasp the fly between them, the leaves being supported by a handle and connected to the handle in such manner that when a trigger is released the leaves will be impaled toward the fly and at the end of their movement will be swung together to grasp the fly between them.

**WELL SCREEN.**—H. BURGARD, 4026 Elk St., New Orleans, La. An object of the invention is to provide a well screen arranged in such a manner that the screen head may be embedded in a gas, water or oil stratum and automatically sealed in position by the strata above. Another object is to provide a screen including outer and inner liners with gravel in the space between the liners.

### Hardware and Tools

**PIPE FISHING TOOL.**—L. WILKINSON, Box 66, Sourlake, Tex. The object of the invention is to provide a tool of the character specified, by means of which a pipe may be



A VERTICAL SECTION OF TOOL

easily and quickly grasped for withdrawal from a well without danger of being accidentally released after it is grasped, means, however, being provided for the release when desired.

**SASH FASTENER.**—T. DADSON, Ulen, Minn. The invention relates to devices which function both as fasteners to hold a sash in closed or open position. A further object is to provide a fastener especially adapted for use in connection with storm sashes, but which may be used in connection with shutters, box covers or similar devices for holding the movable member.

**LOCK.**—M. FLEISHER, 2151 2nd Ave., New York, N. Y. The primary object of the invention is to produce a lock which is adapted for effective use on doors, safes, etc. A further object is to provide a lock having a plurality of simultaneously actuated bolts working in conjunction with a straddle yoke and partly inclosed keeper.

**NUT LOCK.**—C. G. SURBER, 111 N. 8th St., Richmond, Va. The invention relates generally to nut locks, but more particularly to nut locks of the thread gripping type in which the nut has means which automatically act to grip the threads of a bolt, the object being to provide a simple means which will have the advantages of greater ease of manufacture and assembly as well as greater durability in use over the devices of the same general nature heretofore produced.

### Heating and Lighting

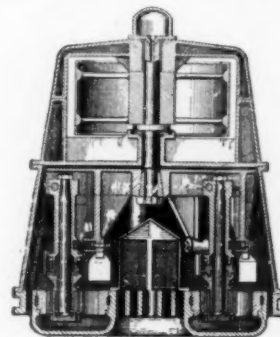
**OVEN ATTACHMENT.**—R. ALBRECHT, 14 Argyle Pl., Arlington, N. J. This invention relates more particularly to baking ovens utilized for the purpose of making bread, etc. An object is to provide a humidifying medium, formed by pipes permitting a passage of a current of fluid therethrough, and means of heating the fluid to produce a vapor within the baking compartment, that the atmosphere may be surcharged with a definite quantity of moisture.

### Machines and Mechanical Devices

**CLOTHES DRYING MACHINE.**—P. W. WHITE, c/o Universal Club, Cleveland, Ohio. The object of the invention is to provide a

clothes drying machine more especially designed for household use and arranged to quickly dry the washed clothes after leaving the wringer and without danger of injuring the clothes. To accomplish the result use is made of a casing and a revolving drum adapted to contain the clothes, the drum having a perforated partition and a fan to circulate air through the drum.

**COMPOUND GRINDER AND PULVERIZER.**—S. H. HERBERT, JR., 3rd and Summit Ave., Fullerton, Pa. The object of the invention is to provide a machine of the character specified designed to crush and pulverize material of



A VERTICAL SECTION OF THE MACHINE

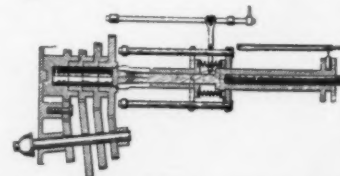
every character, as, for instance, coal, rock, clinker coke, ore, cement and the like, wherein the material is compounded, ground and delivered, a finished product, ready for the market.

**FLEXIBLE COUPLING.**—W. J. FRANCKE, Highland Park, N. J. This invention has for its object to provide a connection arranged to compensate for misalignment of the shafts by the use of flexible members and a floating member. Another object is to equally distribute the pressure, and to retain the floating member in central position between the coupling members and against tendency to float over towards one or other of the coupling members.

**PACKER.**—E. V. CROWELL, Box 611, Tulsa, Okla. The object of this invention is to provide a device especially adapted for providing a water-tight seal in a well for the purpose of cutting off a flow of water, wherein the arrangement is such that the engagement of the packer with the bottom of the well will automatically expand the packer to cause it to seal the well, and wherein the withdrawing of the packer will contract the same.

**OIL LIFT.**—C. W. FISHER, Box 246, Coffeyville, Kan. Among the important objects of the invention is to provide a swab oil lift which will automatically operate to discharge any oil above the swab in excess of the capacity of the lift and to efficiently retain all oil thereabove without the capacity of the lift; the device is entirely self-acting and of strong and durable construction.

**VARIABLE SPEED GEARING.**—K. K. CLARK, 120 W. 57th St., New York, N. Y. An object of the invention is to provide a gear transmission in which the driving and driven gears are always in mesh and to provide means



A LONGITUDINAL SECTION SHOWING THE SHAFT IN IDLE POSITION

for connecting any of the driving gears with the driving shaft. A further object is to provide means for coupling the drive shaft with any one of the driving gears or position the drive shaft so that it turns idly when not transmitting motion to the gears.

**MACHINE FOR DRYING FOODSTUFFS.**—N. C. HERO, 329 Schonpitoulas St., New Orleans, La. The object of the invention is to provide a machine for drying foodstuffs, as for instance hay-meal, ensilage and the like, the machine being so constructed that it will  
(Continued on page 98)

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## PATENTS

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Prices—Today, Yesterday and  
Before the War

(Continued from page 95)

figures set forth above, was in sugar and in bituminous coal. The greatest recession, if comparison is made with the peak price, is in sugar, of which a dollar now buys nearly five times as much as it did during the sugar panic of the early summer of 1920. The lowest peak was in copper, as indicated above (not counting rubber, of course); the least recovery from the peak has been in steel, of which \$100 now buys only half again as much as in last July (this of course excludes anthracite, which is at its peak today). In fact, with the exception of anthracite, and of copper, which had such a low peak that recession is necessarily restricted, there is no other commodity on our list of which the wholesale price has not been cut substantially in half, or more.

## The Mississippi's Mouth

(Continued from page 84)

soil. While some were partially decayed, the most were still well preserved. How to excavate through the unusual mass was a problem to which the hydraulic dredge equipped with the regulation runner had no answer.

The general mode of operation was to cut up the roots and stumps with a cutter and then permit the mixture of cuttings, sand and water to be handled in the usual way. The complex mass had to be pumped through the dredge. But results were poor. Mr. A. B. Wood had already designed and patented a centrifugal-pump impeller adapted to the handling of sewage containing trash. The dredging superintendent, Mr. W. J. White, heard of this and, basing his expectations largely on an inspection of an impeller for a 12-inch pump, reached the conclusion that this type of impeller was the thing wanted. The inventor was ultimately asked to design an impeller for the *Texas*. When installed, the results were remarkable. During the 30 days immediately preceding installation, the dredge had suffered delays from clogged suction which totaled 130½ hours. During the 30 days immediately succeeding installation, the total of delays for the same reason was cut down to 71½ hours. The average yardage was, for the earlier period, 152 per hour, of actual excavation and, for the later period, 445 per hour. This is an increase of almost 200 per cent. Both propellers, the old and the new, had diameters of 6 2/3 feet. However, the new design employed two instead of the former four vanes. The new vanes were given a peculiar shape and the space between them was big enough to swallow up a man. The form and space combined to facilitate the passage of roots and the like and to make it more or less difficult for them to lodge or collect.

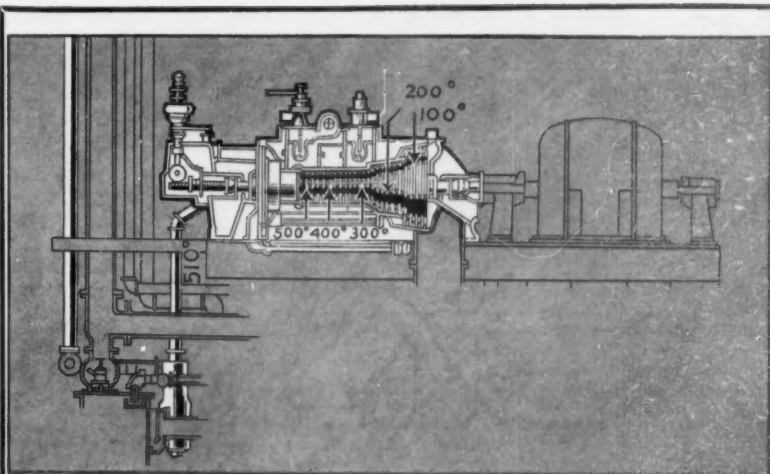
## Power in Big Packages

(Continued from page 86)

36,000,000,000 kilowatt hours. Finally, by the more efficient generation of this energy, the coal burned by the superpower system will then be not more than 14 per cent in excess of that now required.

Logically, in the establishment of the superpower zone, it is the intention to utilize wherever possible the waterpower resources; but as those familiar with this phase of the subject point out nature has prescribed limits to hydroelectric developments within the area. Today the developed hydroelectric capacity has reached 2,198,000 horsepower and it is estimated that the undeveloped sites may give us an additional 3,800,000 horsepower. Therefore, when this maximum is attained we must turn to our coal fields principally to meet the continually increasing demand for energy.

As matters stand today, the predominating volume of the coal tonnage used in the superpower zone is obtained from the conveniently located mines of Penn-

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## RECENTLY PATENTED INVENTIONS

(Continued from page 96)

quickly and thoroughly remove the moisture from the material at a low cost, and within a short time in a continuous passage.

### Musical Devices

**BRIDLE STRAP ATTACHING TIP.**—W. F. OUST, 51 6th Ave., Long Branch, N. J. The invention relates to piano actions and has particular reference to a means for attaching the bridle-strap to the back-stop shank. Among the objects is to provide an attaching tip for the bridle-strap which includes means adapted to coact with a tool for positioning the same, thus eliminating the necessity of removing any of the parts of the action. The attaching tip is simple, inexpensive to produce and efficient in purpose.

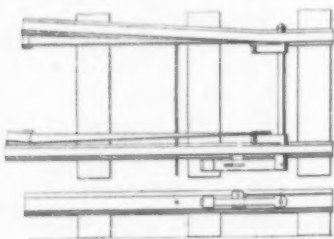
### Prime Movers and Their Accessories

**SHIM.**—J. A. SHARPBACK, Rice's Landing, Pa. The particular object of the invention is to provide a device designed to prevent end play of internal combustion motor crank-shafts, the shim comprising a flat body having an accurate part adapted to be disposed adjacent to a cylindrical element, and means for securing the body in place. An object is to provide a durable shim for taking up wear and preventing end play of motor shafts, and which is particularly adapted for use with crank-shafts of automobile motors.

**GAS ENGINE.**—N. ARREITEL, 787 State St., Bridgeport, Conn. The primary object of the invention is to produce an engine of the internal combustion type having the facility of consuming a fractional part only of fuel for running the engine as compared with the ordinary type of design. More specifically, it is an object to produce a gas engine which draws into the explosion chamber about one-half of the fuel for running the engine.

### Railways and Their Accessories

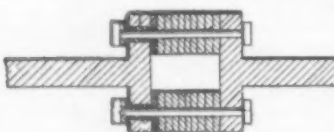
**RAILWAY SWITCH.**—J. H. SKOGMAN, 1514 Moffet Ave., Joplin, Mo. The object of the invention is to provide a switch lock which engages the switch points and locks the same in set position independently of the switch



A PLAN VIEW OF THE SWITCH AS INVENTED stand usually associated with switch points for controlling them, to thereby preclude any possibility of splitting of the switch—due to the high speed of the passing train, to failure of the switch stand to properly operate or to other reasons.

**TIE FOR MINE RAILWAYS.**—F. C. MAYER, Bridgeville, Pa. The invention has particular reference to railways for mines, tram cars or other railways of a relatively temporary nature. Among the objects is to provide a type of railway tie applicable especially for making a reliable joint between metal and wooden rails. Another object is to produce a tie adapted for the direct application thereto of either metal or wooden rails.

**CONNECTING ROD.**—V. NOTARESCHI, Struthers, Ohio. This invention which relates to connecting rods has for its object to provide a rod of the character specified espe-



A HORIZONTAL SECTION AT THE CONNECTION BETWEEN SECTIONS

cially adapted for use with railroad switches and the like, wherein the length of the rod must be varied to suit conditions, and wherein the rod is a continuous rigid structure from end to end.

### Pertaining to Recreation

**TOY ANIMAL.**—J. LEVINE, c/o Globe Teddy Bear Co., 501 Christopher Ave., Brooklyn, N. Y. An object of the invention is to provide a toy animal for children, which is pro-

vided with audible tone producing elements such as a whistle incorporated in the hand, paw or arm of the animal so the toy will respond when taken by the hand or when the animal's hand is grasped by the child, making the toy more amusing.

### Pertaining to Vehicles

**AUTOMOBILE LOCK.**—C. R. RITTER, 521 State St., Freeport, Ill. This invention has for its object to provide means for locking the steering post against rotary movement so that



DIAGRAM SHOWING DEVICE IN POSITION

it is impossible to steer the automobile, and impossible to operate or drag the car away until the steering post is released. The lock can be utilized in connection with any ordinary automobile.

**AUTOMATIC STEERING DEVICE FOR VEHICLES.**—R. DE FILIPPIS, 435 Rodney St., Brooklyn, N. Y. Among the objects of the invention is to provide in connection with a steering member, such as a wheel, or a rudder, a rotary actuator and a connector between the actuator and the steering member, the actuator being provided with means to variably actuate the connector to cause during the rotation any desired control of the steering means either for a straight-away course or for the turning of the vehicle.

**VEHICLE BODY SUSPENSION.**—W. D. HARPER, 620 Paterson Ave., San Antonio, Tex. The invention relates particularly to a swing suspension for the bodies of motor trucks. An object is to provide a suspension between the body proper and the chassis frame for the absorption of shocks ordinarily transmitted to the body where the latter is bolted rigidly to the chassis frame, the suspension being simple in design, efficient in operation, and easily adjustable.

**HEADLIGHT FOR AUTOMOBILES.**—H. F. HAMMOND, c/o N. A. Seraco, 144 Main St., Whitehall, N. Y. The general object of the invention is to so construct the headlight that a strong, bright light is provided for near illumination of the roadway while a comparatively soft light is thrown forwardly for distant illumination without being objectionable to the occupants of other vehicles approaching or to pedestrians.

**CONNECTED BLOW OUT PATCH.**—B. J. LEVIN, 382 Queens Blvd., Winfield, L. I., N. Y. The invention relates to blow out patches for automobile or other tires, and has for its object to provide a construction wherein a strong and accurately fitting patch is provided regardless of the size or shape of the opening to be repaired. Another object is to provide a patch member with a number of connected individual patches adapted to be severed for separate use.

### Designs

**DESIGN FOR A BROAD KNIFE.**—J. J. WATERS, 175 Park Place, Brooklyn, N. Y.

**DESIGN FOR AN IMAGE.**—W. S. SIDELVERMORE, c/o Auto Club of Am., Madison Ave. and 41st St., New York, N. Y.

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sylvania; and it is equally true that not more than 16 per cent of the coal fields east of the Mississippi are situated within easy freight haulage of the neighboring coast. It is manifest, then, that these resources should be conserved as far as practicable for what they represent as natural wealth of steadily increasing value. Further, it is plain, that the nearer the coal deposits are to the region of maximum demand the fewer the ton-miles which will be traveled by the railways to effect the indispensable distribution of the fuel. And this angle of the subject brings us to one momentous step toward transportation economy which the institution of the superpower zone will make feasible, i.e., the erection of central stations right in the coal regions and either at the mine mouth or conveniently near. These plants would have steam turbo-generating equipments of from 300,000 to 400,000 kilowatt capacity, and would be able to transmit current of 250,000 volts throughout a radius up to fully 250 miles. Therefore, instead of the hauling of vast quantities of coal, energy, developed under ideal conditions, would be sent broadcast through the overhead network of conductors.

A point of prime importance in evaluating the various benefits to be derived from the institution of the superpower zone is the effect it will have in inducing a great number of small manufacturers and a goodly array of those of a more pretentious character to cease generating their own motive energy. That is to say, these people will confine their efforts strictly to the making of commodities—concentrating their skill upon turning out textiles, hardware, machinery, etc., and leave the field of power production to a group of experts capable of getting the most out of every pound of fuel expended.

To return to the matter of railway electrification in the superpower zone, it should be borne in mind that the central generating plants have been materially improved in their performance latterly. A few years back, when the electric tractor showed economies of 200, 250 and 300 per cent in comparison with the steam locomotive in passenger, freight or switching service, the thermal efficiency of the central stations supplying the current did not exceed 8 per cent. Today the thermal efficiency is quite 18 per cent, thus bettering proportionately the savings in fuel. The trend is toward bigger steam turbo-generator units having capacities ranging from 50,000 to 100,000 kilowatts, and this increase in size is based upon worth-while economies of various sorts.

Of course, the advantages to be obtained through larger units depend upon running these machines for the greater part of each twenty-four hours at or near their maximum load. It seems that when a central station is carrying a load factor of 40 per cent the plant burns something like 85 per cent of its coal before its kilowatt capacity has been taxed 35 per cent; and the startling feature of operation lies in the fact that the remaining 65 per cent of its kilowatt capacity is made available when the boilers are using up the residual 15 per cent of coal.

The ultimate consumer has to pay for the fuel wastage in industry; and the manufacturer can hold his own in competition with the foreigner only when cheaper power enables him to offset the higher wages obtaining here. Europe undoubtedly counts upon lower priced commodities to wipe out in the main her debt to us amounting to many billions of dollars. The superpower zone should be an instrument toward stemming this inundation of alien goods which threatens the very industrial life of this nation.

### A Matter of Definition

(Continued from page 87)

coat who is leaning against the chimney and talking to Miss Brown; after the introduction this long-winded manner of identification is replaced by simple "Mr. Smith." We have added a man to our

acquaintance, and a word to match him to our vocabulary.

We ought to be willing to do as much when we are reading a popular essay on a subject which is new to us. If it is worth going into at all, it must embody a certain number of new ideas. Some of these, at least, the writer will think are suited for presentation to us. He introduces them, and names them; is it unreasonable in him to suppose that when next in his discourse he has occasion to refer back to this thing he may do so by name? I do not think it is at all unreasonable; I think he has every right to assume that we have added an idea to our stock of ideas, and to our vocabulary the word he has given us to go with this idea. This is one of the places where the reader simply must abandon the rôle of the bucket. But the reader in turn may fairly demand that all new words be thus properly introduced, and that he be not sent to the dictionary.

### Some Horrible Examples

As I read what I have written, it seems that I have said nothing to which any sane person could by any possibility offer opposition. Yet there are a lot of contestants for the Einstein prize who write as though they were sufficiently sane to have grasped the Einstein theories, yet who seem to differ quite radically with what I have said. Among the words which the reader is apparently expected to know and the notions with which he is supposed to be sufficiently familiar to render superfluous any exposition of their content we find transformations and equations of transformation, continuous and discontinuous functions, the degree of a function, tensors and the order of a tensor, the independence of equations, vectors, arbitrary constants, parameters and parametric equations, conditions of integrability, Gaussians, invariance and covariance, quadratic differential forms, complete and partial curvature—and saving the best for the last, one contestant incorporates in his opening sentence a definite integral. Do not misunderstand me; he does not merely talk about definite integrals; he puts one down in black and white, in all its naked and wriggly horror. If our printer could set it up I should quote it here; but it goes a trifle beyond his resources.

Another interesting observation to which a reading of the essays leads is the degree to which the writers have tried or refrained from trying to exclude mathematical technicalities. A good number of them have read into our terms an absolute prohibition of all mathematics. No, on second thought I shall have to revise this statement—they have taken it for granted that *algebra* of every description is taboo. The winning essay, it so chances, is entirely innocent of the use of even an  $x$  or a  $t$ ; but it has not been the understanding of myself or of the judges that this extreme abstinence was necessary, and a number of essays with algebraic expressions in them got the most serious consideration.

### How Much Mathematics?

That there is something to be said on our side of this question would be clear to anybody if certain of the competing essays were printed. There is beyond question a great deal of geometry that is vastly more complicated, more abstruse, and altogether more removed from the possibility of the layman's comprehension than the elements of algebra. Most of the essays which were scrupulous to the extreme in excluding every suggestion of algebraic notation went quite to the other extreme in matters of Riemannian and four-dimensional geometry, and introduced with the utmost recklessness concepts which cannot by any stretch of the imagination be justified in a popular essay. It seems that this establishes, if not actually bad faith in applying the criterion of non-technicality, at least very bad judgment indeed. Moreover, the per-

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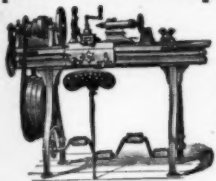
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son who is entirely strange to the fact that letters can be used to represent numbers, to the reasons for such usage, and to some notion of how it is practiced, would be a person quite unequipped to go any appreciable distance in pursuit of modern scientific concepts. I see no reason to suppose that such a person would be interested in Einstein or able to understand anything about him, in any style of presentation. So among the essays that will be published as of the best submitted, there will be found those that go to what the judges have considered to be reasonable lengths in the use of algebra.

Of course horrible examples are at hand here, as before. Complete algebraic demonstration of the principles underlying the Michelson-Morley experiment is a rather common fault, one essayist carrying this to the equivalent of 900 words. The notation of proportion seems rather beyond the elements of algebraic expression, yet it is freely used. One author brings in most of the letters of the alphabet as subscripts; we consider numerical subscripts to be pretty rough on the lay reader, and literal ones almost an automatic disqualification. It may seem trivial to suggest that a man will never read intelligently anything that he can't pronounce, but we think the psychologist will bear us out in this. If he won't, we shall merely have to say that the man who needs all these subscripts, or his fellow who requires all the English letters and most of the Greek ones in the bargain, is carrying his algebra beyond the point that is reasonable in a popular essay. Perhaps more absurd is the idea of one contestant that the linear transformation  $T_1 = pT_1 + qT_2$ ;  $T_2 = rT_1 + sT_2$  needed only to be mentioned thusly in order to convey its meaning to the popular audience; or of another, that when he writes

$$ds^2 = g_{ik} dx_i dx_k$$

with no explanation beyond the parenthetic remark "ten terms written collectively," anybody except the judges was going to know what he was talking about.

As a matter of fact, excesses in matters of algebraic or analytic notation are not so serious a matter as excesses in the matters of vocabulary or of demands upon the reader's scientific background. Symbols like the above can't be disguised; they shout their presence from the house-tops. But unreasonable demands of the other sort are far more insidious. In the first place, the judges are bound to know what the questionable passage means; yet alert as they may be, they are far more likely to fail to realize that it is not intelligible to the layman than if it stood out in all the stark boldness of a summation sign or a flock of differentials. And in the second place, the lessened visual appeal again operates in the case of the lay reader himself. When he comes to a line of symbols that he can't read at all, he knows that he is stuck; but a smooth statement in words that really means nothing to him he may read without his attention ever becoming fixed by the fact that he has failed to understand. Yet it is not desirable to draw the line of demarcation so low that the essays which get over it are so "simple" as to tell nothing of consequence about the Einstein theories. As a matter of fact, as many of these were eliminated as of the other kind.

**Where the Printer Gets His Ink**

(Continued from page 88)

sheet iron, size 8 feet by 2½ feet, angle iron and plenty of common wire bolts and rivets to fasten the sheet iron on to the frame.

It is common practice for carbon black manufacturers to use a steam engine with high pressure gas as power, then to exhaust the expanded gas into the low-pressure main just back of the gasometer. This furnishes continual power at no expense other than lubricating oil. A thirty-horsepower engine is about the right size

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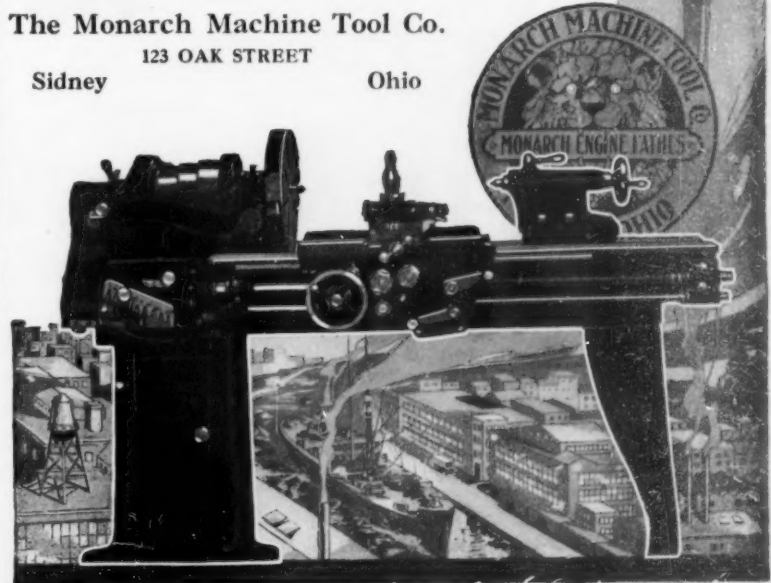
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for a thirty-building plant. The pressure of gas entering the cylinder ranges from fifty to one hundred pounds or about the same as steam. The gas is exhausted into the main at a low pressure.

On account of liability of the cylinders to frost, interfering with the lubrication of the piston, the gas is first run through a coil consisting of about 150 feet of two-inch pipe laid in the burning building nearest to the engine, where the gas is heated and enters the engine cylinders, considerably above the atmospheric temperature, and all liability of frosting in the cylinder is eliminated.

After the carbon is scraped from the channel irons or collecting plates it falls down through a hopper or funnel into the carrying pipe. This carrying pipe is an eight inch conveyor pipe running the full length of each burning building and carries a constantly revolving worm which forces the carbon toward the end of the building where it falls into another but larger size conveyor pipe, likewise carrying a constantly revolving worm which forces the carbon to the bolting or sifting house. Hence it falls on to a belt conveyor, where it is carried up to a height of ten or twelve feet, where it falls into the first revolving bolter. This first bolter contains a screen of eight meshes to the inch and separates the hard particles, dirt or scale. The screened carbon then falls out into a second conveyor and is carried up and dropped into a second bolter where a fifty-mesh-to-the-inch screen is used. After passing through the second bolter it is carried to a third bolter, with now a sixty-mesh-to-the-inch screen. After being screened in the third bolter it is conveyed to the bin on the second floor of the building where it is kept until it passes through the automatic packers below into the sacks ready for boxing for shipment.

### Are We Abusing Our Water Resources?

(Continued from page 90)

plants and animals which form the source of food supply for the fishes. Therefore our streams not only lose their attractiveness to the camper and fisherman, but they actually come to be regarded as so much waste and barren water.

Just how can this best be brought about? First of all we must remedy the situation of stream pollution. This, however, is not an easy matter. We cannot establish laws which point blankly prohibit the discharge of any foreign substance into fresh waters. That would not be feasible nor economically just. In the first place we do not know just what effect the various substances have upon the fish or upon other organisms of the stream. Secondly, there are many industrial plants which would be forced to go out of business if they were not permitted to dump their refuse into a nearby stream or lake. Some of the wastes could doubtless be transformed into useful products and thus be kept out of the streams but the cost of installing the necessary machinery in many instances becomes prohibitive. The whole question needs much detailed and careful study.

Organic wastes, such as domestic sewage, milk wastes, etc., should be studied with a view of transforming them into plant and animal life and ultimately into food for man. These organic wastes should be the fertilizers of the water and not the contaminants. Some of the European countries have succeeded in turning domestic sewage into fish food. Investigations of thirty or more dairy plants in the State of New York by the author have disclosed some very interesting facts regarding the methods of disposal and possible use of milk wastes. One such industry which manufactures condensed milk discharges every day thousands of gallons of milk washings into a nearby brook. This brook thereby becomes entirely depleted of all fish and other fresh water organisms. In place of these an entirely new association of

organisms appear, of the kind that grow and thrive in foul waters. The milk washings in the above mentioned brook produced first a thick white fleecy growth which covered the entire bottom of the brook and all overhanging vegetation. This growth was found to be a culture of bacteria held together in these long filaments by a gelatinous secretion. Amidst this bacterial growth occurred myriads of microscopic animals, called ciliata, flagellata, etc. A little farther down stream were found millions of red worms half an inch or more in length. These worms are known as blood-worms and are relished as food by fishes. It was found that the little contaminated brook discharged its water into a larger stream about a mile below the point of entrance of the milk wastes and into this stream the brook brought down the blood-worms in such large numbers that it seemed desirable to estimate the amount of this fish food which was being brought into the stream. A conservative estimate showed this to be at least five pounds per hour or 120 pounds every twenty-four hours. The fact that these blood-worms were relished by fishes was shown by the presence of hundreds of fishes, large and small, that were waiting in the larger stream for the appearance of these rich morsels of food. Thus through a series of life cycles the waste milk became transformed into the choicest fish food, and though the milk waste contaminated the little brook, it supplied vast quantities of food to the larger stream and thereby made it much more productive of fish life. Such conditions, however, do not exist in many streams, but this example serves to illustrate the possibility of utilizing some of the organic wastes. The practicability and exact methods of converting such products into fish food or other useful products need further investigation.

### The New United States Battleship "Constellation" and Class

(Continued from page 91)

reduced from 24 small to 18 larger boilers, and the whole of this plant is below the protective deck. The added beam of the ships has been devoted to anti-torpedo protection, which is so complete in these vessels that it would take several torpedoes to sink them.

By long odds the most daring innovation is the installation of a turbo-electric plant of the enormous capacity of 180,000 horsepower. Current will be generated in four huge main generators and led to the eight propelling motors, of which there will be two, placed in tandem, upon each of the propeller shafts. The success achieved by the Navy Department in the collier "Jupiter," followed by the performance with the "New Mexico," and other ships, encouraged the Bureau of Steam Engineering to apply the electric drive on this vast scale.

It is not customary in these days to say much about the armor plan of ships, and both we and the Japanese are reticent on this subject, although the British have given full details regarding their latest armored ships built during the closing years of the war. However, it is evident from the official sketch that "Constellation" will have a water line belt of considerable depth, and it is probable that she will embody sloping armor, built within the interior of the ship, and extending from side to side somewhat like the roof of a house, for the purpose of serving as a shell buster, to detonate shells as far as possible above the protective deck. If this has been done, it will prove to be an admirable protection, worth much more in safeguarding the vitals of the vessel than the same weight of heavier vertical armor would be.

This subject was discussed by the writer in an article published in the SCIENTIFIC AMERICAN of April 7, 1917, in which it was shown that the increasing ranges in Naval engagements, with the steeper angle of fall, called for a complete redistribution of the armor.



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